ISSUE 160 DEC./JAN. 2004/2005

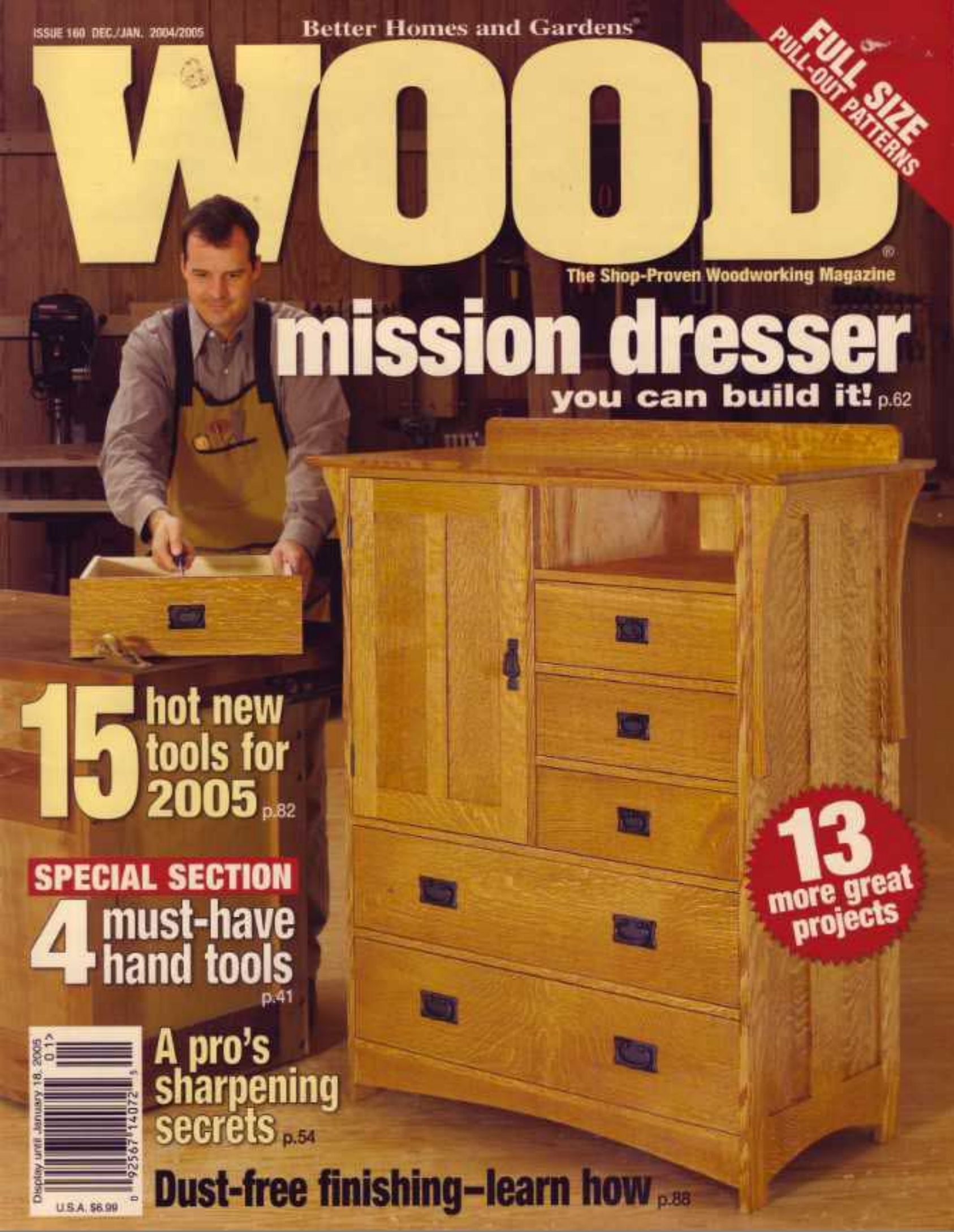
Better Homes and Gardens®

WOOD®

The Shop-Proven Woodworking Magazine

FULL SIZE PULL-OUT PATTERNS

mission dresser
you can build it! p.62



15 hot new tools for 2005 p.82

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4 must-have hand tools p.41

A pro's sharpening secrets p.54

Dust-free finishing–learn how p.88

13 more great projects

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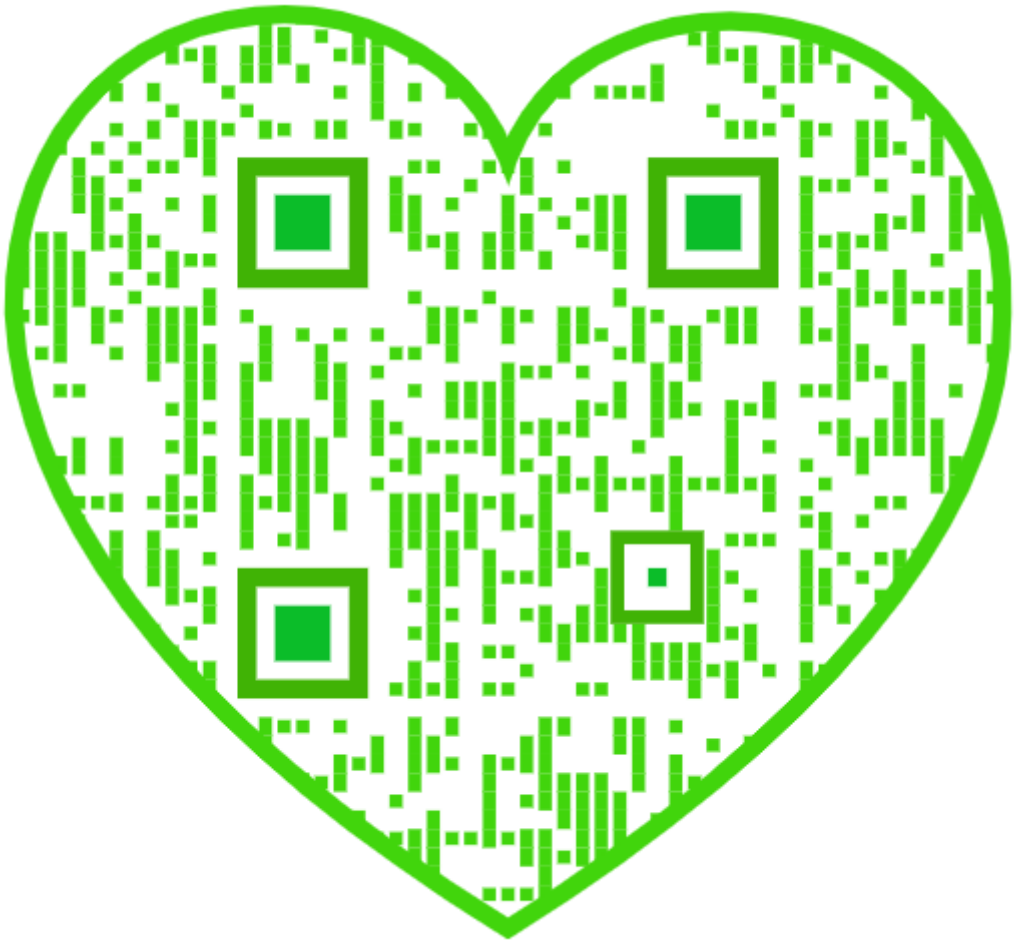

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Better Homes and Gardens®

WOOD®

December/January 2004/2005 Vol. 21, No. 7 Issue No. 160

Jim vowed to clean up his shop, and designed a slew of organizers to do just that.

Jeff recently designed and built this buffet/server for a friend.

Cheryl made these bandsawn heart boxes as gifts.

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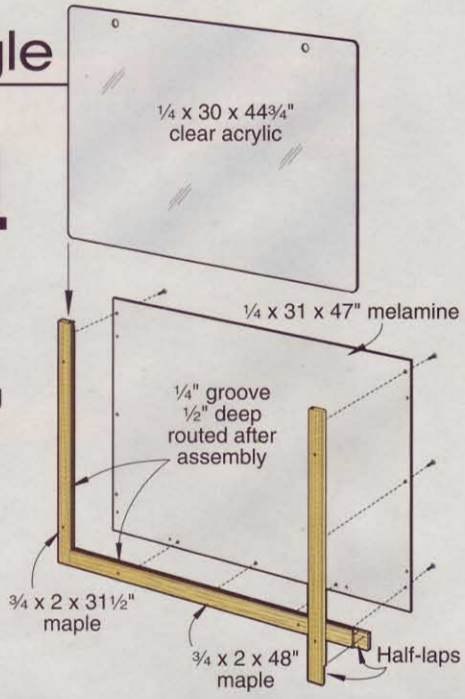
Circle No. 50

editor's angle

A feel-good project

Would you like to use your woodworking skills to benefit your local community? Consider this simple art-frame project.



A few months ago I was asked if the *WOOD*® magazine staff would be interested in contributing its collective woodworking talents to help spruce up the hallways and classrooms of a local nonprofit day-care facility. The cause sounded worthwhile, so I got together with the facility's director who cited a need for frames to hold the children's artwork. But, as I quickly learned, these frames have special requirements.

First, they have to be big enough to hold multiple pieces of art. The frames require a protective acrylic cover that removes easily for changing the artwork. And the frames must be positioned at the eye level of a 3- or 4-year-old child. One more thing, we needed to build 26 of them.

Some day-care kids mug it up with *WOOD* magazine staff members, from left, standing: Marlen Kemmet, Sheryl Munyon, Chuck Hedlund, Kevin Boyle, and Jeff Mertz; kneeling: Jim Harrold, Karl Ehlers, Bill Krier, and Bob Wilson.

With that mind, Kevin Boyle, our senior design editor, drew up plans for the simple 31½×48" maple frame illustrated *above*. (Go to woodmagazine.com/frameplan for a free, enlarged, fully detailed drawing.)

Next, staff members shown in the photo got together to mass produce the frames during a few quick work sessions in the *WOOD* magazine shop. It was a great experience building and installing the frames, and then seeing the children taking great pride in their artwork on display.

Our special hand-tool section

Now I have to admit that we made the art frames strictly production-style with tablesaws, jointers, routers, and other power tools. For more refined woodworking, I suggest you master one or more of the hand tools in the special section beginning on *page 41*. In addition to enjoying better results, you'll appreciate the relaxing benefits of low-dust, low-noise woodworking.

With that said, I need to make another admission. My shop has several pricey hand planes that don't see a lot of use—I've just never been thrilled with the results I got from them. But after seeing Tim Peters, a veritable wiz with hand planes, effortlessly take paper-thin shavings with a block plane, I'm a changed man. Now I know why my hand planes don't work that great for me, and I'm determined to do something about it. I'm glad we had someone with Tim's extensive knowledge help us with the block plane and sharpening stories. Learn more about him on *page 53*.

Happy woodworking—with or without a power cord.

Bill Krier

sounding board

Your bulletin board for letters, comments, and timely updates

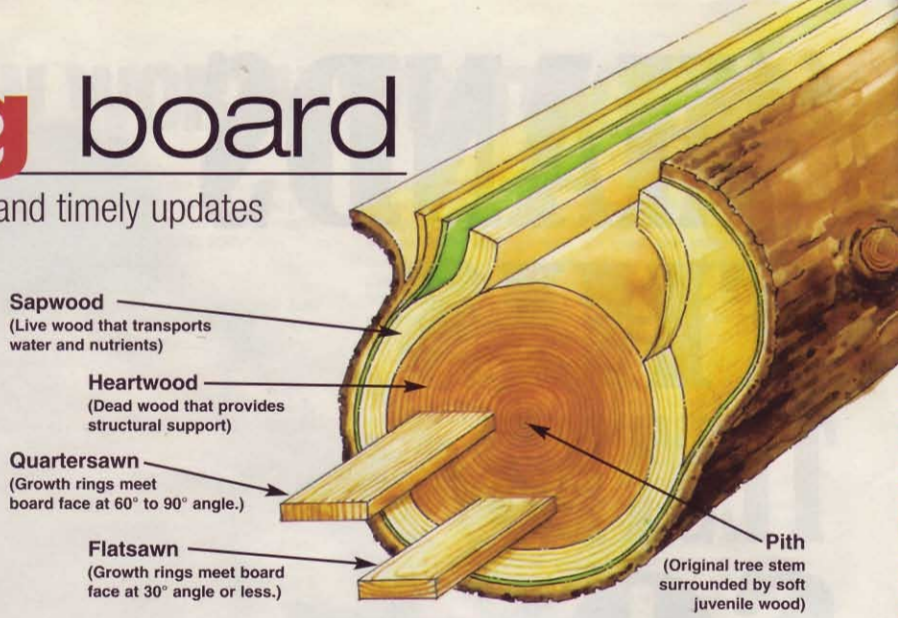
Wood anatomy series says it all

I've been a subscriber since issue one, and I continue because your magazine just keeps getting better. The four-part series called "The Woodworker's Guide to Understanding Wood" stands as a good example of this. (See issues 155, 156, 157, and 158)

We can't truly be good woodworkers unless we fully know the material we work with. I am 51 years old and have worked with wood since I could reach the top of a tablesaw. Some of the things you discuss in the series I had heard before; some I had learned over years of working with the material. Your series put all that information together in an organized format that helped me understand why things happen.

I wish I had had this kind of information when I started out. A lot of projects would have been better built!

Jerry Carpenter, Brooksville, Fla.


Sapwood
(Live wood that transports water and nutrients)
Heartwood
(Dead wood that provides structural support)
Quartersawn
(Growth rings meet board face at 60° to 90° angle.)
Flatsawn
(Growth rings meet board face at 30° angle or less.)
Pith
(Original tree stem surrounded by soft juvenile wood)

Article Updates

Shop Proven Products (issue 157, page 117): The phone number for Avenger Products has changed to 702/293-7510.

Entertainment Center Tower Cabinet (issue 157, page 52, Drawing 10): The groove in the bottom edge of the upper door rail (BB) should be 1⅝" deep.

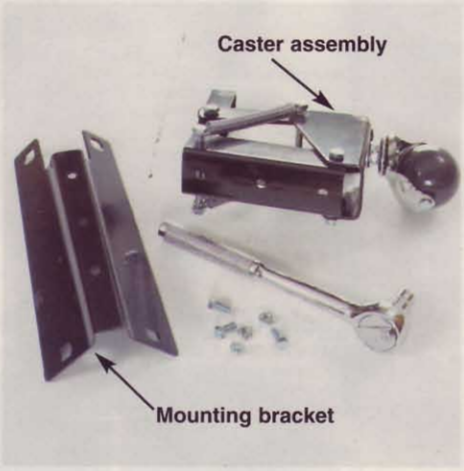
Workbench gets rolling with retracting casters

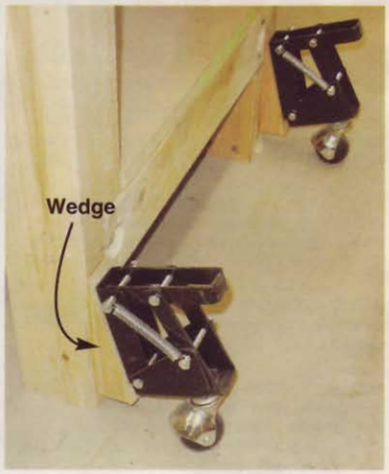
I came up with a new way to use the Woodcraft Retracting Casters (#141550) that you tested in the September 2004 issue of *WOOD*® ("Wise Buys," page 39). Although these casters are marketed primarily for contractor-style tablesaws with splayed-leg bases, I used them to make my workbench mobile.

First, I removed the brackets from the caster assemblies, as shown, *near right.* Next, I cut four 1⅝×6" wedges from scrap 2x4 stock, and then glued and screwed them to the legs of my bench. Finally, I mounted the caster assemblies (without the brackets) to the wedges, as shown in the photo, *far right,* using ¼" lag screws.

Now, for only $40, I have a system that allows my bench to move easily, but still sit solidly on its legs when in use.

Richard Besemer, Tucson, Ariz.





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- **Updates to previously published projects:** For an up-to-date listing of changes in dimensions and buying-guide sources from issue 1 through today, go to woodmagazine.com/editorial.

Readers air views on air-dried lumber

Your editorial on air-dried lumber (issue 156, page 8) pointed out the positives about air-dried lumber. I'd like to add my thoughts on risks involved with this wood.

- Stability: Modern heating and cooling systems make indoor humidity very low year round in many buildings. Kiln drying to an equilibrium moisture content below that which the wood will experience in later uses greatly reduces the tendency to "explode," as you described. To ensure that the wood remains stable, you should stack and sticker it where it will be used.
- Disease and insects: Wood is full of them, but they get killed off by the high temperatures used in kiln-drying. If disease and insects invade your house, they can spread to other wooden pieces.

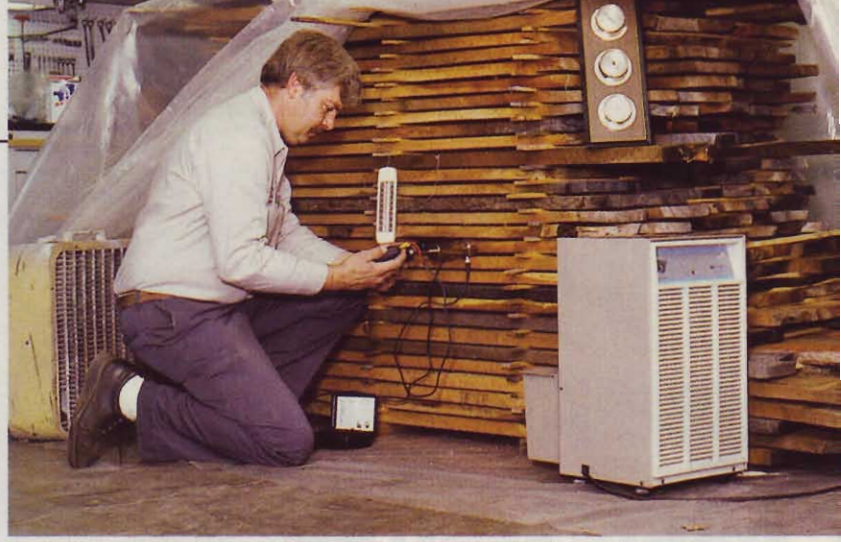
Even with these risks, I am fond of using wood that I have cut myself or someone has given to me. If you don't have space or time to air-dry your wood, or you are worried about the risks I mentioned, seek out a small sawmill or kiln operation that accepts wood from amateurs for drying.

David Gibson, Kittery Point, Maine

I enjoyed reading Bill Krier's insights on air-dried wood (issue 156, page 8). For years I've purchased undried red oak from a mill and dried it in my basement. I aid the process only by painting the ends to minimize checking and running a dehumidifier near the stack.

Because I don't have a moisture meter, I use a bathroom scale to determine when the wood has reached equilibrium moisture content (EMC) and is ready to use. To do this, I mark and weigh one of the largest pieces in the stack. Then I recheck and record its weight regularly over the next few months. When the weight stabilizes, I know the boards have reached EMC.

Frank Nye, Hackensack, Minn.



To further reduce the moisture content of air-dried lumber, make your own "dehumidification kiln" from sheet plastic, a dehumidifer, and a fan.

Over the years I've stacked a lot of wood for air-drying at my family's lumber business. I'd like to add my insights to your comments in the June/July issue.

- Coat the ends of the boards with paint or wax to reduce checking.
- Make all the stickers the same size (roughly 1" square), and space them evenly, right up to the ends of the boards.
- When drying outside, cover the stack with builder's felt. It keeps water off boards that are too long to fit under a sheet of plywood.

Cal Kunkle, Largo, Fla.

Choose the right gloves for shop use

In the "Epoxy Goes Mainstream" article found in the June/July 2004 issue (page 28), the author recommends wearing latex disposable gloves when working with epoxies or solvents. As a research chemist, I know that latex gloves provide good protection when working with water-based materials, such as latex paint and ordinary white vinegar. Such chemicals as acetone, lacquer thinner, denatured alcohol, and mineral spirits rapidly permeate latex, though. That means latex gloves provide little protection when working with these and similar organic solvents.

When working with common shop chemicals, nitrile gloves protect better. They cost about 50 percent more than latex or vinyl, but still offer inexpensive protection against solvent exposure.

Remember also to change gloves frequently when working with solvents or epoxy. The reason? Chemicals found in these products eventually permeate even the best gloves.

Bill Honnick, Exton, Pa.

Thanks for the advice, Bill. Here's some information on commonly available disposable gloves.

MATCH THE GLOVE WITH THE TASK AT HAND

Latex:
- Protects against alkalines, rubbing alcohol, water-based solutions, ketones.
- Flexible, durable, but may cause allergic reactions in some users.
- Cost: About $.10 each.

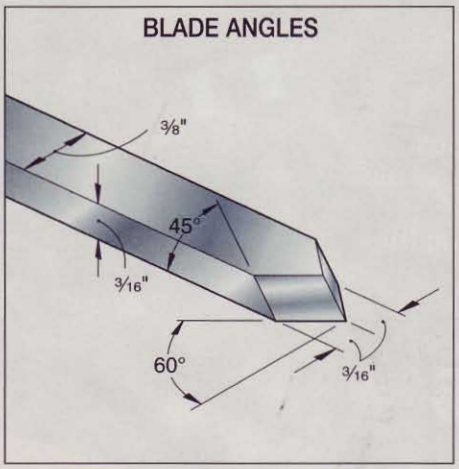
Vinyl (PVC):
- Protects against acids and alkalines, salts, water-based solutions, alcohol.
- Less flexible and durable than latex; not known to cause allergic reactions.
- Cost: About $.10 each.

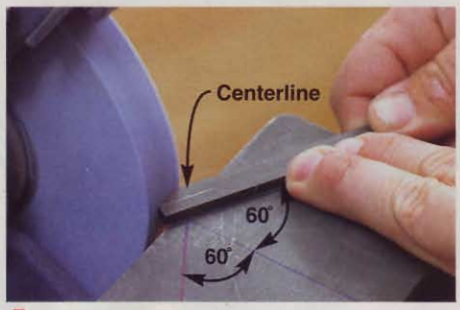
Nitrile:
- Protects against oil, grease, aliphatic chemicals (glue, solvents), xylene, toluene.
- Flexible, durable, not known to cause allergic reactions.
- Cost: About $.15 each.

making a blade

With the right steel, you can make a keen, durable blade in your own shop.

Making a custom blade for a hand tool, such as the marking knife on *page 42*, might seem out of reach, until you discover grade W-1 tool steel. (See **Source.**) You can cut this metal with a hacksaw, shape it with a grinder, and then harden the cutting edge by heating it with a propane torch and quenching it in cold water. (First heat the steel to a red glow, and then keep it at a red glow for two minutes for each 1/16" of thickness.) That's it! Using a 3/16×3/8×6" bar of W-1 tool steel for the marking knife blade, here's how to shape and sharpen the blade shown in the drawing, *below left*.





1 GRIND THE POINT

Mark 60° guidelines on your grinder tool rest and position it perpendicular to a 100-grit grinding wheel. Mark a centerline on the tool-steel bar with an awl. Grind the V point, cooling the bar with water as needed.

2 GRIND THE BEVELS

Tilt the tool rest to a 45° angle, and start grinding one bevel. Check the angle with a protractor, and adjust the tool rest as necessary. Then grind bevels on both sides of the point, forming sharp edges.

3 HEAT THE POINT

Using a propane torch, heat about 1¼" of the ground end of the bar, moving the flame back and forth until the entire 1¼" length glows red. Now continue to heat the steel, keeping it glowing red for six minutes.

4 QUENCH THE STEEL

After keeping the tip glowing red for the needed time, immediately plunge the bar in cold water. Then run the steel under cold water until it is cool enough to handle. The tip is now hardened and will hold an edge.

5 HONE AND POLISH

Placing 220-grit, then 320-grit, and finally 400-grit wet/dry sandpaper on a flat surface, hone the bevels, and polish the top, bottom, and sides of the bar. Buff to a bright finish with a buffing wheel and Tripoli compound.

Source

Tool steel. Water-hardening grade W-1 tool steel available in rods (140 sizes), flat bars (30 sizes), and squares (13 sizes) in 3' lengths. Prices from $1 to $70. To view all sizes and prices, go to mcmaster.com, and type *W-1 tool steel* in the search window. For the marking knife on *page 42*, you can order a 3/16×3/8×36" flat bar of grade W-1 tool steel no.8895K29, $4.92 each (plus shipping) online, or call McMaster-Carr Supply Co. at 630/833-0300.

match color under the right light

Not all lighting is the same. To match finishes perfectly, coordinate your workshop lights with the light where you'll place your project.

To color-match a tray that would normally be displayed beneath incandescent lights, we supplemented the fluorescent lights in our shop with an incandescent light.

Next time you're in the paint aisle of a store, study how paint chip displays are lit. Chances are the paint manufacturer included special lights on its displays, and for good reason: Light sources can play tricks with how you perceive color. Different light sources also can throw off your ability to match dyed or stained wood.

The red, orange, yellow, green, blue, indigo, and violet that make up sunlight, as shown in the chart *below left*, are reproduced, to an extent, by artificial lights. The amount and strength of each color varies by the type of light. For example, cool white tubes in fluorescent fixtures—a common choice for workshops—cast a cool, greenish-blue light that downplays the red portion of the light spectrum, as you can see in the chart *below middle*. Standard incandescent lights, shown in the chart *below right*, emphasize yellow and red, but not green and blue.

To match the finish on a project to another piece of furniture or a sample, first match your light spectrums. For example, the lack of red in fluorescent lights saps the red color from a warm mahogany-stained finish while the warm color of incandescent lights may exaggerate the red tones.

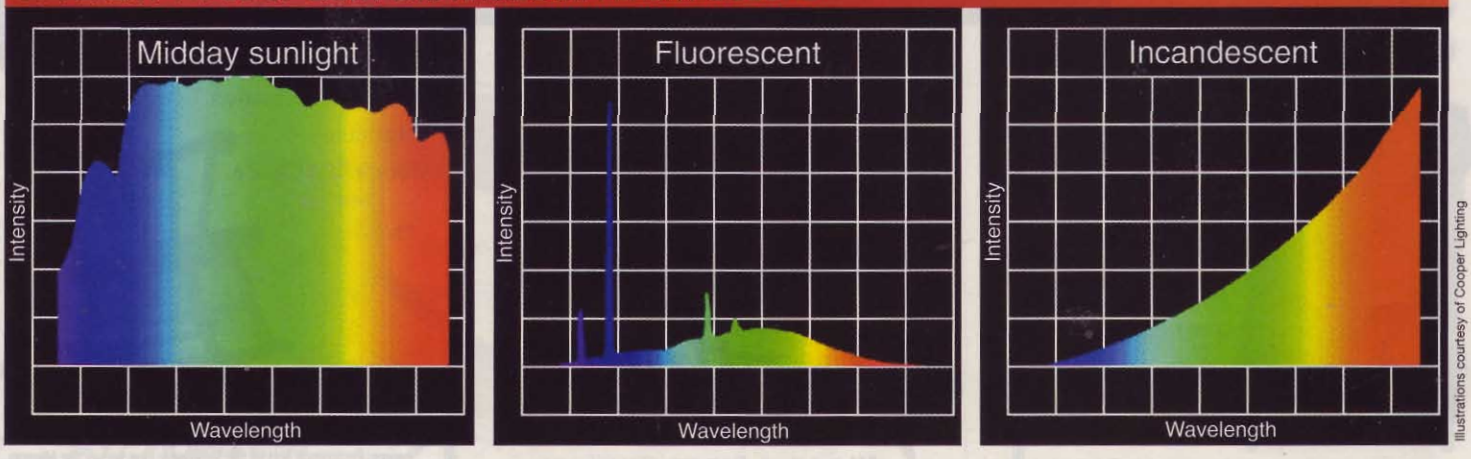
Problems start when you try to match colors under a light source that will change once the project leaves your shop. "You don't have any red in fluorescent lighting, so you tend to stain things much too red under fluorescent light," cautions Alan Noel, an Atlanta furniture finisher. "The rule that's always worked for me is to match things under natural light. If it matches outside, it matches anywhere."

Noel matches colors at his indoor spray booth, which is fitted with halogen lights. Of all the incandescent light sources, halogen is closest to the natural light spectrum.

More color-matching tricks

- Make sample pieces using the same brand and shade of stain or dye (from the same can is ideal) you'll use on the project, and finish them with the same topcoat to avoid gloss or color differences. Using different wood coloring products for the sample and the project could leave you vulnerable to a problem called metamerism. That's when two objects appear the same color under one light but different colors under another type of light.
- Purchase or mix enough wood coloring products to complete your current project and any additional projects you expect to build later as part of the same collection. This is especially important when you mix wood dyes in your workshop. Fortunately, mixed dyes can last for years.
- If you can't place a sample under the light source where the finished project will be located, reproduce the lighting in your shop, as shown in the photo *above*.
- Upgrade your shop lights. Replace bargain-priced cool white tubes with warm white tubes that produce a broader spectrum of light.
- Even the color of sunlight varies with the time of day. Morning light has a cooler, bluish cast while afternoon sun has more warm yellows. For the best balance, use midday or early afternoon sun as your color benchmark.

DIFFERENT TYPES OF LIGHT EMPHASIZE DIFFERENT COLORS



Illustrations courtesy of Cooper Lighting

our editors test

four-jaw chucks

Why buy?

Whether you're a long-time turner or a novice, you deserve a four-jaw chuck for your lathe. This versatile accessory benefits bowl turners with its ability to secure turning stock by closing around a spigot (a round tenon on the end of a bowl blank) much like your drill chuck grips a bit. A four-jaw chuck also can secure a workpiece by expanding into a recess, such as a hollowed-out bowl bottom. With the chucks reviewed here (sometimes called scroll chucks), all four jaws close and open simultaneously, self-centering the workpiece. And, unlike a three-jaw chuck, four-jaw models hold turning squares just as easily as a turned spigot.

Grizzly G8784, $37

Mounting threads: 1"×8 tpi (others available)
Spigot capacity: 1¾–2½"
Recess capacity: 2⅛–2⅞"

Editor test-drive:

In spite of a few limitations, this is a great chuck, especially given its price tag. Before chucking up a workpiece, I noticed some play in the jaw sliders, and worried that the 3/16"-deep dovetail jaws would be inadequate for turning large vessels. However, the diminutive dovetails gripped flawlessly while I hollowed out end grain on a 5"-diameter green applewood bowl. I even caught my gouge several times on a knot without dislodging the blank.

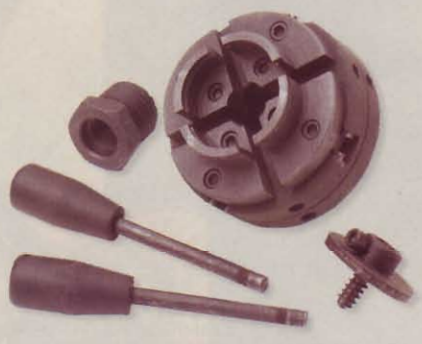
The G8784's jaws held equally well when I expanded them into a shop-made chuck to turn the outside of the bowl. Although I was pleased with its grip on this smaller workpiece, I wouldn't push it beyond shallow bowls or platters up to about 10" in diameter, or vessels wider or deeper than 8".

The G8784 uses two tommy bars to operate (similar to using two wrenches on a router collet), which isn't unusual, but a third hand would sure be nice to hold the workpiece when mounting it. Although the jaws are removable, Grizzly offers no screw-center insert for this chuck, or accessory jaws, such as those available for premium-priced scroll chucks.

—Tested by Jan Svec, Projects Editor

To learn more: 800/523-4777; grizzly.com

Penn State C3418, $47



Mounting threads: 1"×8 tpi or ¾"×16 tpi
Spigot capacity: 1⅝–3½"
Recess capacity: 2–3¾"

Editor test-drive:

I've used a premium four-jaw chuck for years, so I was curious to see how this model—costing only about one-fourth as much—compares. After using the C3418 to turn several bowls, including one from an 8×8" block of rock-hard oak and another from an 11"-diameter piece of box elder, I must say that I'm impressed. The workpieces showed no signs of vibration or strain, regardless of whether they were held by a spigot, recess, or the included screw-center insert (a nice bonus for reverse bowl mounting).

The C3418 installs directly on lathes with a 1"×8 tpi spindle, but an adapter for ¾"×16tpi spindles comes with the chuck, so you can use it on your mini-lathe, and then step it up to a midsize lathe as your skills grow. The tommy bars used to secure the workpiece in the chuck aren't as convenient as my premium keyed-jaw chuck, but they do have nice comfortable handles. Except for the parts list, the C3418 comes without any instructions, so there's no guidance on capacities, speeds, the size and shape of the recess to fit the jaws, or the hole size for the screw center.

—Tested by Owen Duvall, Projects Editor

To learn more: 800/377-7297; pennstateind.com

Super Nova 2, $200

Mounting threads: all common sizes
Spigot capacity: 1¾–2⅜"
Recess capacity: 2–2⅝"

Editor test-drive:

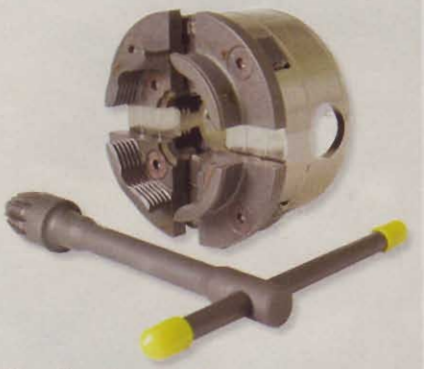
The first two things I noticed about the Super Nova 2 were its substantial heft (about 8 pounds) and the outstanding machining, making this one beautiful and vibrationfree chuck. This unit recently replaced the much-respected Super Nova chuck in the Teknatool line, and it's every bit as good as the original with at least one significant improvement: Instead of a geared key to open and close the jaws (like an oversize drill chuck) the Super Nova 2 uses a ball-head hex driver: essentially a T-handled hexhead wrench that works even if it's inserted at a slight angle.

In use, the ⅜"-deep dovetail jaws of the 50mm chuck I tested provide a lot of gripping area and the included "woodworm" screw-center insert supplements the holding power. Teknatool offers a number of accessory jaws for the Super Nova 2, including 75mm jaws ($25) and "Cole" jaws ($90) for reverse-chucking bowls or platters up to 10" in diameter. If you buy a bigger lathe with a different spindle size, simply replace the threaded adapter with one sized for your new tool. A new adapter costs about $25.

—Tested by Marlen Kemmet, Managing Editor

To learn more: 866/748-3025; teknatool.com

Oneway Talon, $210



Mounting threads: all common sizes
Spigot capacity: 1⅝–2⅞"
Recess capacity: 2–3⅜"

Editor test-drive:

This beautifully machined chuck, designed for mini and midsize lathes, is a downsized version of Oneway's Stronghold chuck (which should be used instead on lathes with 16" or more of swing capacity). The jaws open and close with a single key, similar to the chuck key on a drill press, so I can hold the workpiece with one hand while tightening the chuck with the other. Many similar keyed chucks are reverse threaded, but the Talon is intuitively threaded "lefty-loosey, righty-tighty" for tightening on a spigot. Also, a safety system prevents the user from accidentally extending the jaws to the point where they come out of the chuck body.

I don't like the serrated jaws of the Talon as much as dovetail jaws: They don't self-center as well on the spigot, and in face-grain turning, I found locations where the spigot was starting to split due to the serrated edges. That's not a problem when turning spindles, and accessory dovetail jaws (Oneway calls them "smooth" jaws, $30) remedied the splitting. You also can add jumbo jaws and flat jaws for expanded faceplate turning. An outstanding aggressively threaded screw-center insert (not shown) comes with the Talon.

—Tested by Jeff Mertz, Design Editor

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mission mirror

This Arts and Crafts-inspired looking glass also reflects your woodworking talents.

Though a perfect companion to our Arts and Crafts-style dresser on *page 62*, this mirror also works as a stand-alone accessory for a bedroom or hallway. That's why we provide mounting options for a wall or dresser.

Make 1" stiles from ¾" stock

1 The 1"-thick oak used for the stiles (A) isn't always easy to find, but it can be easy to make from ¾" stock. To begin, cut three pieces 2¼×22¼" from ¾" quarter-sawn white oak.

2 Arrange the three boards with the two best faces on the outside. Mark the inside faces to indicate the glue side, as shown in **Photo A**.

3 Glue and clamp the three pieces together to make a 2¼×2¼×22¼" piece, keeping the edges and ends flush.

4 Scrape off any excess dried glue and rip the piece to 2" wide. Bandsaw the piece in half, as shown in **Photo B**. Then *plane the glue-up to 1" thick*. Cut two stiles (A) to a final length of 21¼".

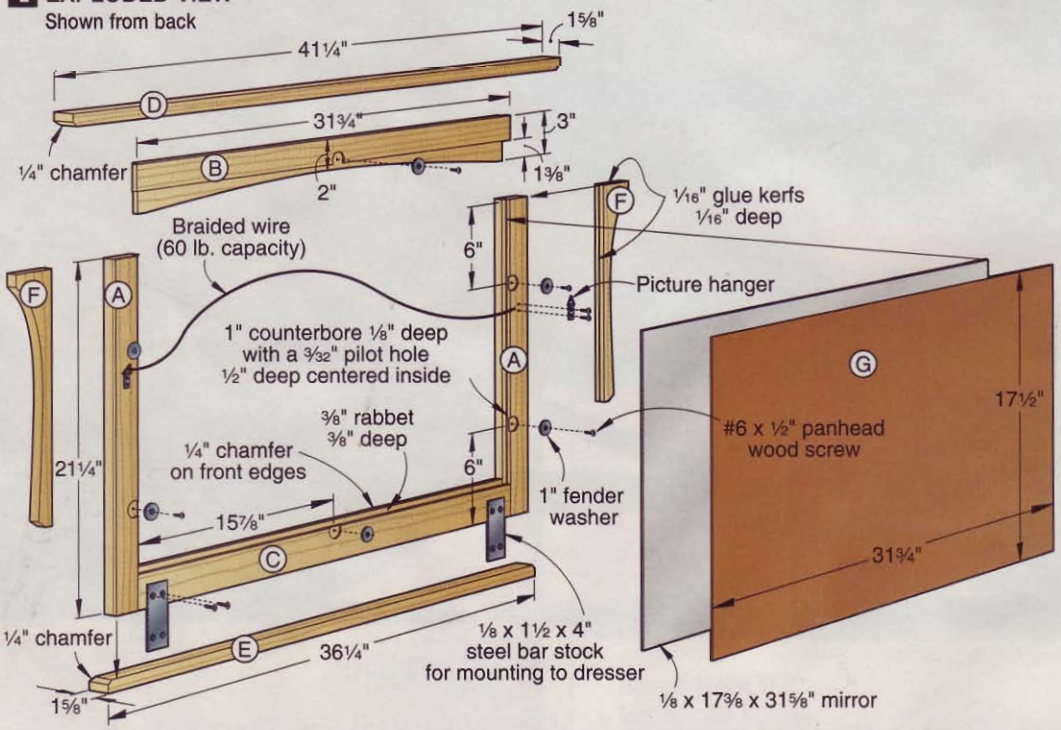
Create the remaining parts

1 Cut the top rail (B), lower rail (C), top (D), base (E), and two blanks for the corbels (F) to the sizes specified on the **Materials List**.

2 Refer to **Drawings 1** and **2**, and cut rabbet joints on the ends of the top and

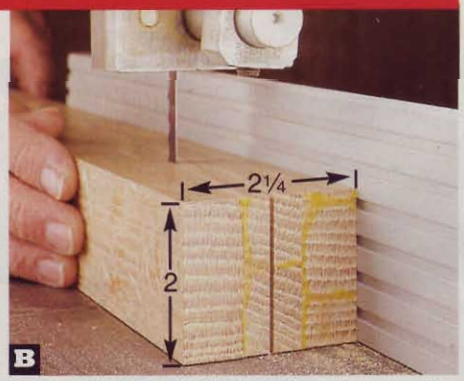
Continued on page 24

1 EXPLODED VIEW
Shown from back



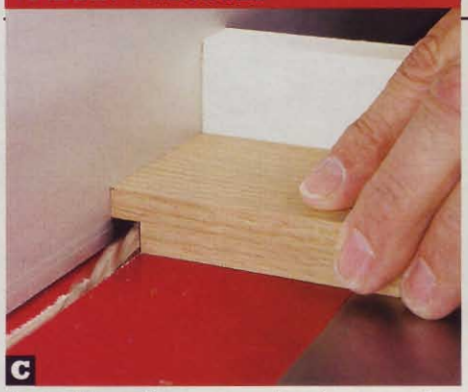
DON'T HAVE 1" STOCK? TRY THIS

Face gluing three ¾"-thick pieces creates a 2¼"-thick blank for ripping the stiles



Bandsawing the 2¼"-thick blank leaves ⅛" extra to remove for the final 1" thickness.

RABBET THE RAILS



C

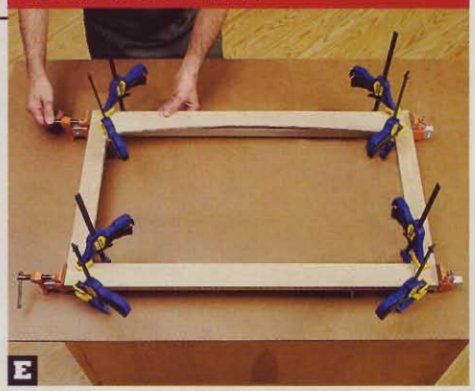
An auxiliary miter-gauge extension supports workpieces to prevent chip-out.

MARK THE TOP RAIL ARCH

D

A fairing stick is a flexible piece of wood that can be pulled into a curve to establish an arc.

FORM THE FRAME



E

Clamps keep the rabbeted joints both flat and square to form the frame.

lower rails using a standard saw blade or dado set, as shown in **Photo C**. Do not move the fence yet.

3 Along one inner edge of both stiles, cut a ⅜"-deep rabbet, as shown in **Drawing 2**, so that the rail ends will fit flush with the stiles on the back side.

4 Cut a ⅜"-deep rabbet along the top edge of the lower rail (C).

5 To cut the top rail (B) rabbet, raise the blade to 1⅜" and place the most attractive face against the fence. Cut the rabbet in two passes for a ⅜" finished depth.

6 Mark the cut line for the top rail (B), where dimensioned on **Drawings 1** and **2**. Note the ½" flat spot on the bottom edge of each end of the rail, where shown on **Drawing 2**. As shown in **Photo D**, we used a fairing stick to mark the arch. Bandsaw and sand the arch to shape.

7 Using a router table equipped with a fence, rout a ¼" chamfer along the inside edge of the front face of the lower rail (C), where shown in **Drawing 2**.

8 To create recesses for the fender washers used to hold the mirror in place, use a 1" Forstner bit to bore six counterbores on the back side of the frame, as dimensioned on **Drawing 2**. Then drill a 3/32" pilot hole ½" deep centered in each 1" counterbore.

9 Control glue squeeze-out by cutting 1/16"-deep glue kerfs along the edges of the corbels and rails, as shown in **Drawings**

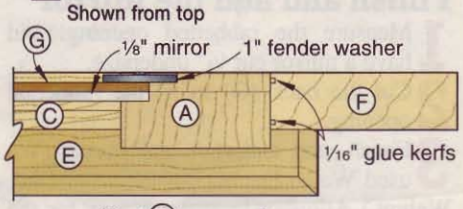
1 and 2. Kerfs are placed 1/16" in from the faces and stop about 1/4" from the ends on the corbels (F).

Begin building the frame

1 Glue and clamp the stiles and rails together, as shown in **Photo E**. Keep the ends of the stiles flush with the backs of the rails, as shown in **Drawing 3**. Check for square by measuring diagonally for equal distances. Later, sand the frame smooth.

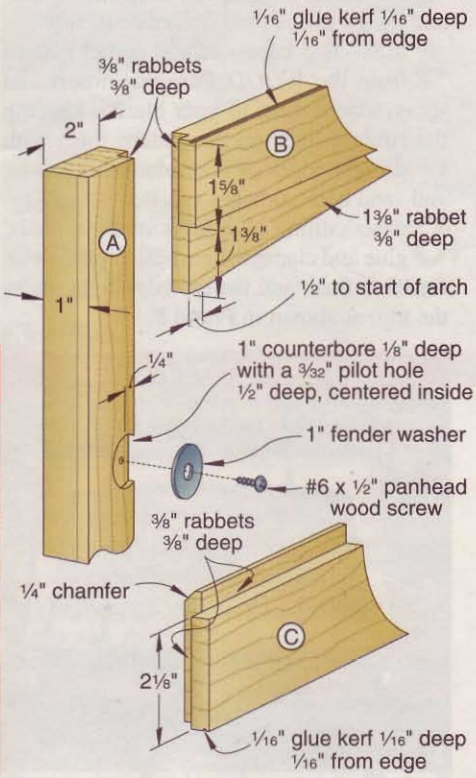
2 Rout a 1/4" chamfer on the ends and the front edge of the top and base (D, E).

3 SECTION VIEW
Shown from top



We used a fence on the router table plus a miter gauge with an auxiliary extension to prevent chip-out. Be sure to rout the ends before cutting the long edge.

2 STILE AND RAIL DETAIL
Shown from back



SHOP TIP

Kerfs control squeeze-out

Glue kerfs keep squeeze-out off the face of the rails, top, base, and from around the corbels. Set the saw blade height to 1/16" and the fence 1/16" from the blade. Where the blade starts to touch the wood, make a pencil line on a piece of tape near the blade. Add another pencil mark 1/4" in front of the cut line to serve as a stopping point for your cuts. Cut the first kerfs in the corbels and other pieces as instructed. After making all these cuts, move the fence to place the blade 9/16" from the fence and make the second set of cuts to complete the kerfs, as shown at *right*.

Continued on page 26

Our new AIRgrip Laser Level utilizes innovative vacuum technology, allowing you to attach the level to a variety of smooth surfaces without using pins or tacks. So when you're hanging paintings on expensive wallpaper or putting up chair rail on your custom paneling, you don't have to puncture what's priceless just to get a level. Just use AIRgrip. You'll never know it was there.

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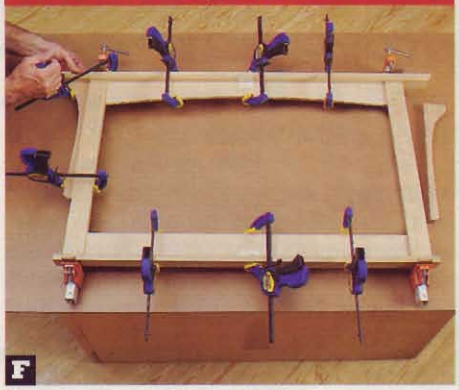
RYOBI

3 Center and clamp the top and base to the frame, keeping the back edges flush and the parts centered from side to side.

4 Make two copies of the corbel pattern from the *WOOD Patterns*® insert and spray-adhere them to your blanks, keeping the straight lines on the pattern flush with the straight edges of your blanks. Bandsaw and sand both corbels to shape.

5 After cutting glue kerfs in the corbels, glue and clamp the corbels in place with the back flush and the top edge tight under the top, as shown in **Photo F**.

ADD CORBELS, TOP AND BASE



Bar clamps provide a place to leverage smaller clamps for attaching the corbels.

Finish and add the mirror

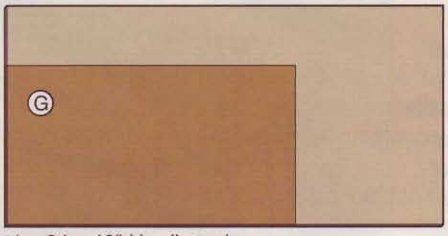
1 Measure the rabbetted opening, and have a mirror cut ⅛" undersize.

2 Cut the back (G) to fit the rabbetted opening.

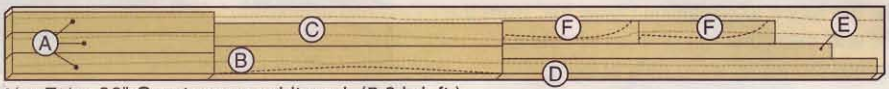
3 Finish-sand and stain the frame. (We used Watco Danish Oil Finish in Dark Walnut.) Allow at least three days for the oil to dry before sealing the finish with two coats of polyurethane, sanding lightly between coats.

4 Install the mirror and then the back. Attach the fender washers with #6×½" panhead wood screws to secure the mirror.

Cutting Diagram



⅛ x 24 x 48" Hardboard



¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)

5 If you plan to hang the mirror, use picture hangers and braided wire as shown in **Drawing 1**. To attach it atop a dresser, use the bar stock where shown.

Written by **Bob Wilson** with **Chuck Hedlund** Project design: **Kevin Boyle** Illustrations: **Roxanne LeMoine**

Materials List

Mission Mirror	FINISHED SIZE T	W	L	Matl.	Qty.
A* stiles	1"	2"	21¼"	LWO	2
B top rail	¾"	3"	31¾"	QWO	1
C* lower rail	¾"	2½"	31¾"	QWO	1
D top	¾"	1⅝"	41¼"	QWO	1
E base	¾"	1⅝"	36¼"	QWO	1
F* corbels	¾"	2½"	15"	QWO	2
G back	⅛"	17½"	31¾"	HB	1

* Parts initially cut oversize. See the instructions.

Materials Key: LWO—laminated white oak, QWO—quartersawn white oak, HG—hardboard.

Supplies: 1" fender washers (6), #6×½" panhead wood screws, picture hangers and 60 lb.(or greater) braided wire or ⅛×1½×4" steel bar stock (2), ⅛×17⅜×31⅝" mirror.

Blades and bits: Chamfer router bit, 1" Forstner bit.

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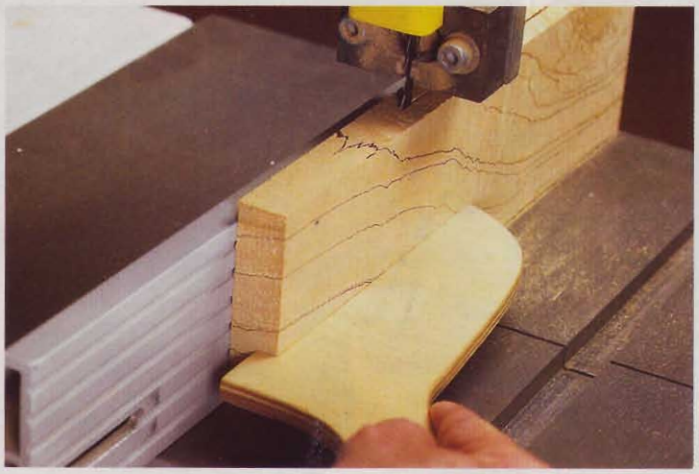
the short story on book-matched panels

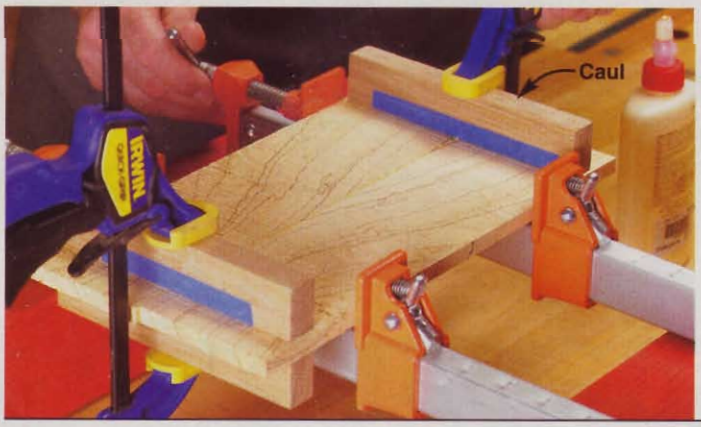
Create a happy ending by marrying mirror-image panels in 4 easy steps.

Book-matched panels, such as the ones used in the doors of the Shaker clock in the inset photo at *right* or the Arts & Crafts dresser on *page 62*, add visual interest and a mark of fine craftsmanship to a project. What is book-matching? It's a simple process. Just resaw stock; open it like a book to expose two nearly identical mirror-image surfaces, as shown *above*; and edge-glue the pieces together in the same "open-book" orientation.

The key to creating an attention-grabbing panel lies in careful stock selection. Look for wood with unusual grain, a knot, or color variation that will form an interesting pattern when mirrored. The eyes or swirling grain in burls and the decay-induced lines in spalted wood, such as the maple *above*, make excellent choices. With your selection in hand, here's how to quickly transform it into a beautiful panel.



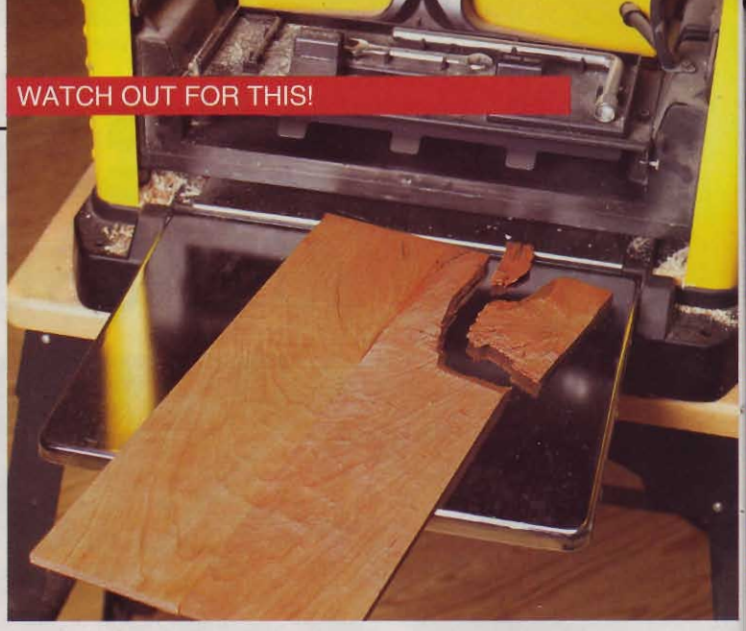
1 Resaw the workpiece. To make a ¼"-thick panel, start with a surfaced piece of ¾"-thick stock. This allows ¼" of waste material for the saw kerf, removal of the saw blade marks, and planing and sanding to final thickness. Then draw a centerline along one edge of the piece. Using your bandsaw with a ½" blade with 4 teeth per inch, resaw the piece, finishing your cut with a pushstick.



2 Plane and glue the panel. Plane the resawn faces of the pieces only enough to remove the saw marks and establish a uniform thickness greater than the finished ¼" thickness. (You'll plane the panel to final thickness after glue-up.) Avoid excessive planing of the resawn faces that can expose new grain patterns or characteristics that may not match up well.

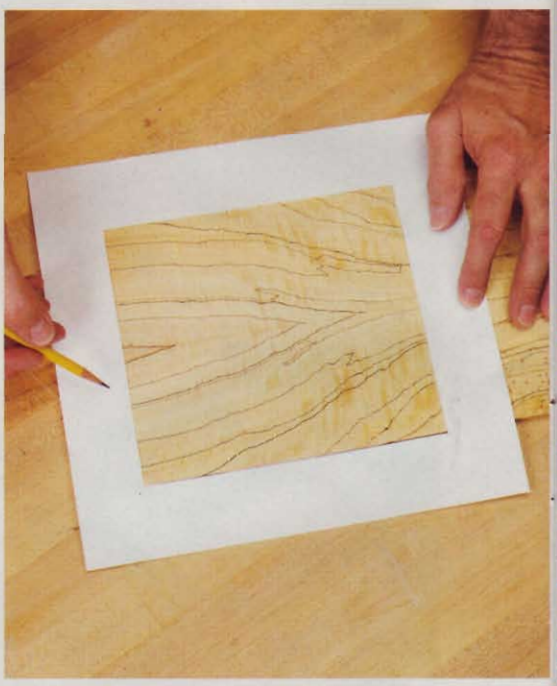
Edge-glue and clamp the pieces together, as shown, being careful to align the grain pattern as closely as possible. To keep the panel flat, clamp cauls across it made from scrap ¾" stock. Apply easy-release painter's tape to the cauls to prevent them from sticking to the glue squeeze-out.

Continued on page 30



3 Finish-sand and plane. Lightly sand the resawn face of the panel to 220 grit using a random orbit sander or a horizontal drum sander. Then, with the resawn side facedown, plane the panel to the finished ¼" thickness to fit the mating grooves in your project.

Be aware that because of the reversed grain direction in the panel halves, it is possible for the panel to fracture when you plane it. This happened to us while planing the cherry panel shown at *right*. To help prevent this, use a sharp set of blades in your planer and take very light cuts, or avoid the problem altogether by using a drum sander. Also, if your planer has a speed-control selector, set it for the maximum cuts per inch (typically the finishing position).



4 Trim the panel. To help you select the most interesting area on the panel, make a paper mask with an opening cut to the finished size of the panel. Move the mask around on the panel and, when you've framed the most appealing character, outline it with a pencil. Now crosscut and rip the panel to the marked lines, and you're ready to incorporate this beautiful, one-of-a-kind feature in your project.

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Spinner speeds vise adjustment

Q: The end vise on my workbench takes an annoyingly long time to adjust. How can I get a speed boost without plunking down a huge amount of money for a nut-release model?

—William Bradley, Memphis

A: A steering wheel spinner attached to the bar of the vise will put your adjustment speed into high gear, William. This inexpensive accessory also eliminates bashed or pinched fingers. Spinners are no longer a common item at auto parts stores, so you'll have better success at shops that sell riding mowers. We purchased ours from Northern Tool and Equipment (800/221-0516 or northerntool.com). Ask for item #16931. The one shown costs $12.99 plus shipping.

Twirling a steering wheel spinner opens and closes your bench vise quickly when it doesn't have a quick-release mechanism.

The nuts and bolts of threading wood

Q: I'd like to incorporate threaded wood bolts and nuts into an upcoming project. Is this a difficult process to set up and learn?

—John Schroeder, Evansville, Ind.

A: To answer your question, John, we tried out two threading systems and got good results with both. The first is a hand-powered threadbox with a V-shape cutter that slices the threads into a dowel. We found a ¾" die (item #G1868) for $16.50 from Grizzly Industrial, 800/523-4777 or grizzly.com. A tap for making ¾" threaded holes is $8.50 (item #G1869). To use the threadbox, apply slight downward pressure for the first few turns. After that, the wood thread engages the nut inside the threadbox and begins feeding itself. If you just want to try threaded dowels, the manual threadbox will get you started and make clean cuts in straight-grained woods.

The Beall Wood Threader uses a router to drive a carbide bit supplied with the threader kit. This jig must be set up precisely to work properly. Before you cut the threads, follow the directions to tap a sample hex-nut. This serves as a guide for setting the router's depth of cut. Don't aim for too tight a fit because any change in the moisture content of the wood might hamper assembly.

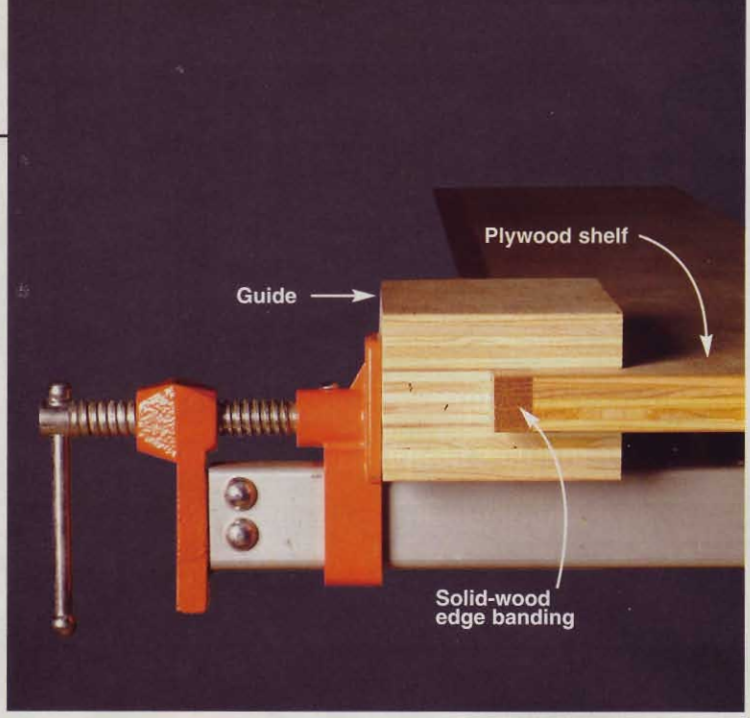
Prices range from $74 for a ½" threader to $179 for a set to do four sizes (Beall Tool Co., 800/331-4718 or bealltool.com). The Beall tool also lets you make smooth cuts even in difficult materials. We found the Beall tap easy to start squarely because an unthreaded pilot engages the hole before the bit begins cutting. You can remove the pilot to convert the tool into a bottoming tap that cuts threads nearly to the bottom of a hole.

You can cut threads manually with a traditional threadbox shown *above left* or add a Beall jig to your router for a power assist, as shown at *above right*.

Got a question?

If you're looking for an answer to a woodworking question, write to **Ask WOOD, 1716 Locust St., GA-310, Des Moines, IA 50309-3023** or send us an e-mail at **askwood@mdp.com**. For immediate feedback from your fellow woodworkers, post your question on one of our woodworking forums at www.woodmagazine.com.

perfect-alignment edge-banding guides



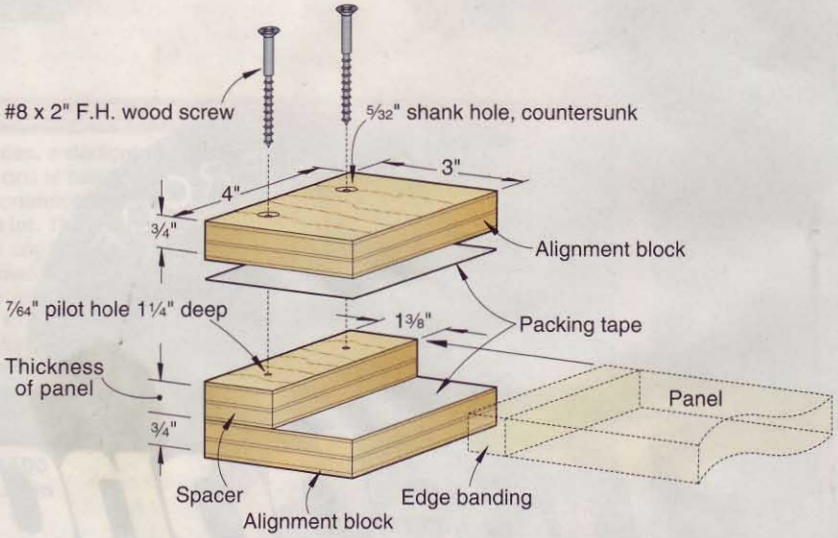
Plane edge banding to the exact thickness of your plywood, and then use these simple guides for perfect clamping alignment.

Although you can use these shop helpers when edge banding any part, they really save the day when attaching the bands after a case is assembled and there's no room for error. Such is the case with the Arts and Crafts dresser on *page 62*.

To build the guides, cut pairs of 3×4" alignment blocks from scraps of ¾" plywood. (We recommend one guide for every 8–10" of band length.) Then cut spacers from scraps of the plywood, particleboard, or medium-density fiberboard you'll be edge banding. To keep excess glue from sticking to the guides, apply plastic packing tape to the alignment blocks, where shown on the drawing. Next clamp a spacer between each pair of alignment blocks, drill countersunk screw holes, and drive the screws.

To use the guides, first plane the edge bands to the exact thickness of the panel receiving it. Use one of the guides as a thickness gauge, testing the edge bands for a tight fit. Then follow the steps *below*.

EDGE-BANDING GUIDE



TWO EASY STEPS TO PERFECTLY ALIGNED EDGE BANDING

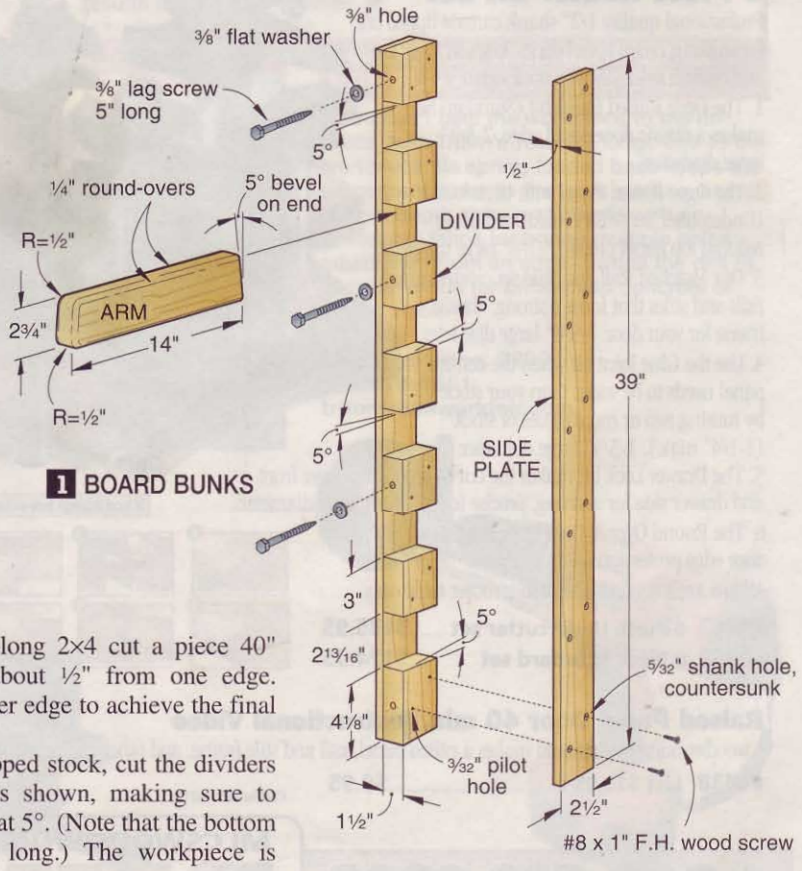
With the edge banding seated in the clamping guides, apply a centered bead of glue. To avoid squeeze-out, apply the glue sparingly.

Clamp the edge banding in place. To give the far clamp jaw a surface to bear on, apply the edge bands with the case back off.

Triple-threat storage for lumber, scraps, and sheet goods

Build one or all three of these easy-to-make projects to keep your shop organized.

Storage Solution 1: Adjustable board bunks



1 BOARD BUNKS

Make as many of these adjustable racks as you need to store boards flat and out of the way. Wall-mount them over studs.

1 To make each rack, start by cutting two pieces of ½" plywood to the sizes shown on **Drawing 1** to create the side plates for the board bunk.

2 From an 8'-long 2×4 cut a piece 40" long. Rip about ½" from one edge. Then rip the other edge to achieve the final 2½" width.

3 From the ripped stock, cut the dividers to length, as shown, making sure to miter both ends at 5°. (Note that the bottom divider is 4⅛" long.) The workpiece is

longer than you'll need, but this allows you to work around knots to make the dividers as strong as possible.

4 Cut a spacer 2 13/16"-wide from a scrap of 2×4 stock, and use this as a spacer to align the dividers. Now glue and screw the dividers to the plates, where shown.

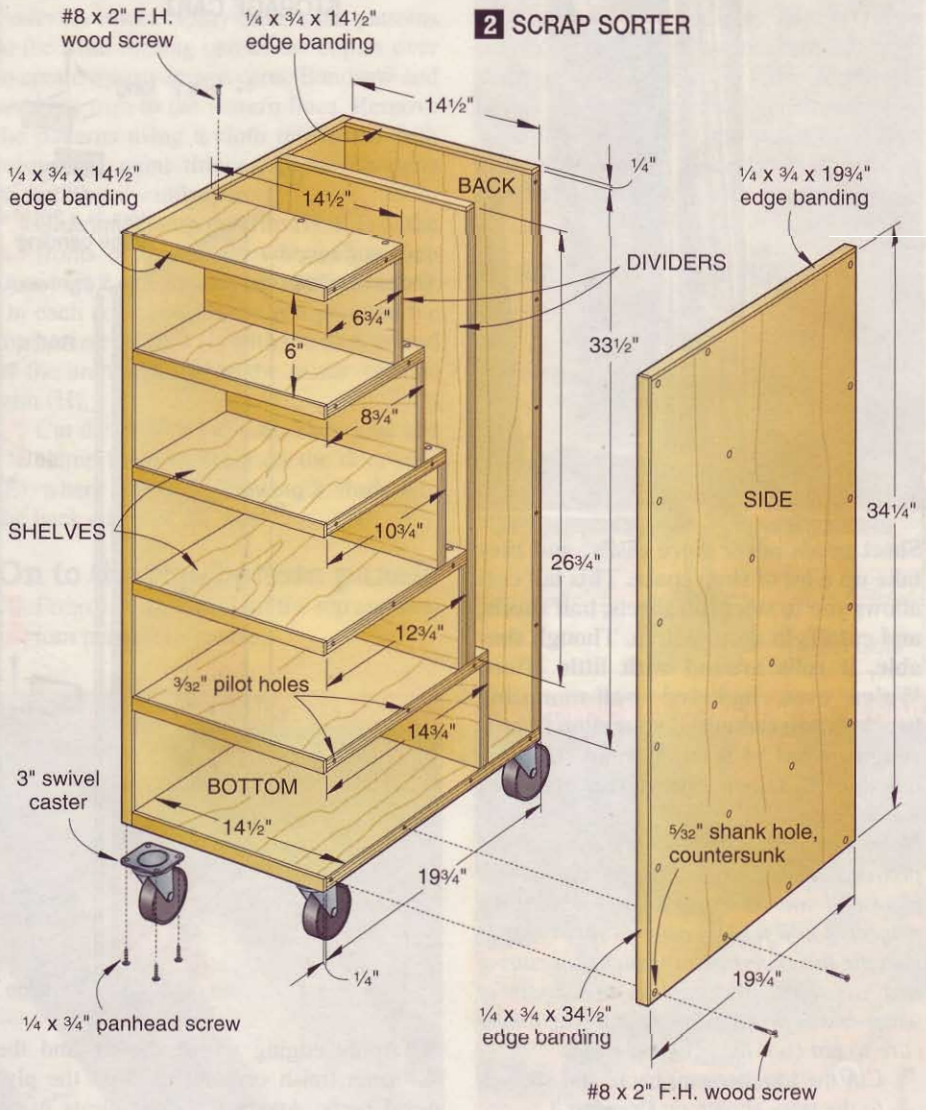
5 To make the arms, rip a second piece of 2×4 to 2¾" wide. Again, avoid sections with knots to ensure maximum strength. (We made four arms for each rack assembly.) Miter one end of each arm at 5°. Then rout ¼" round-overs on the edges and ends where shown. Don't rout the mitered end. Sand all the parts through 150-grit, and apply a clear finish if desired.

6 To mount the rack assembly, locate your walls studs, and then drill ⅜" holes through four of the dividers, as shown. Use these holes to mark your wall, and then drill ¼" pilot holes 2" deep into the studs. (If the studs are exposed—no drywall—then make the pilot holes 2½"-deep.)

7 Screw the rack assembly onto the studs using ⅜×5" lag screws, spacing them every 16" or 24". Slip in the arms, and add your prized lumber stock.

Storage Solution 2: Shop-smart scrap sorter

Corral your cutoffs with this handy mobile cart. It lets you organize your stock by length so you'll always know exactly what you have at a glance.



1 Begin by cutting the plywood sides, shelves, and dividers to the sizes shown on **Drawing 2**.

2 Rip stock (we used poplar) to size to create the edge banding. Then apply the edge banding, where shown. This will dress up the project while protecting the plywood edges from nicks.

3 Place both side pieces face to face and drill shank holes for the #8×2" screws that will hold the cart together. Also drill shank and pilot holes, and then assemble each of the divider cubbies.

4 Sand the parts through 150-grit, and apply two coats of clear finish to all the cart's pieces.

5 Now assemble the cart. We used screws only—no glue—to allow tweaking the fit of each piece.

6 Install four 3" swivel casters to the bottom corners of the cart, where shown. To do this, turn the cabinet upside down, place a castor at each corner, mark and drill the holes, and screw the castors in place.

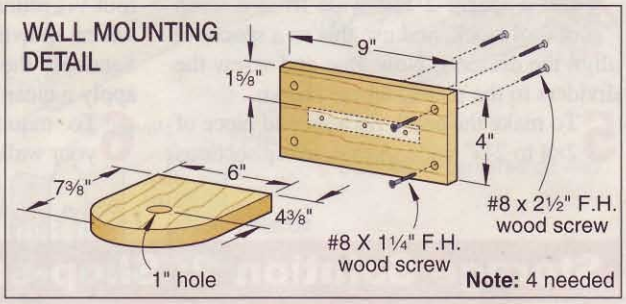
Storage Solution 3: Upstanding sheet storage cart

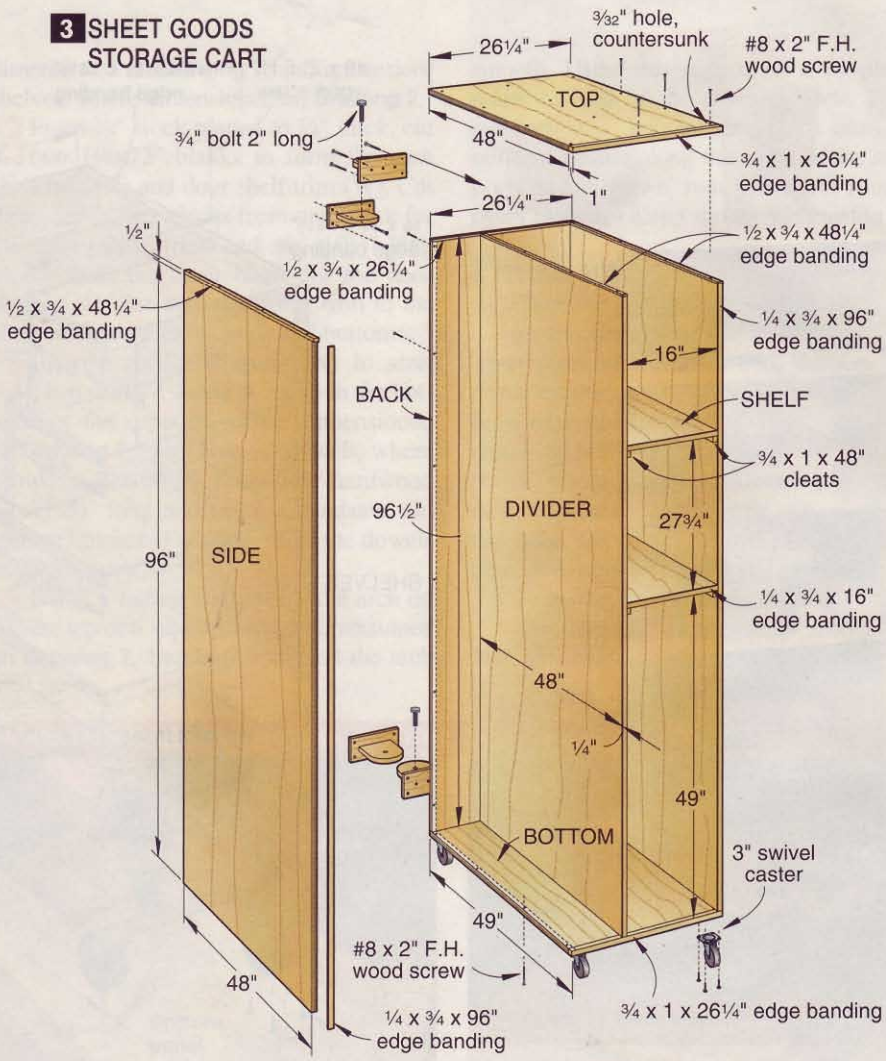
Sheet goods never store easily, and they take up a lot of shop space. This tall cart allows you to store full sheets, half sheets, and cutoffs in a small area. Though sizeable, it rolls around with little effort. We've even included wall-mounting brackets you can add if your shop floor is rough or out of level. If your ceiling is less than 9', take a pass on this project.

Note: *For structural strength, we used ¾" plywood; five sheets suffice for the project shown. If you intend to finish or paint the project, you'll find it easier to simply apply it to the full sheets before you begin cutting and assembly. We applied two coats of water-based finish using a paint pad, taking care to not coat the plywood edges.*

1 Cut the top, bottom, back, and shelves to the sizes shown on **Drawing 3**.

2 Next, cut edge banding (we used poplar) to the sizes shown in the drawing. Note that the edge banding on the front edge of the top and bottom extends these plywood parts by 1", whereas the edge banding on the front edges of the top, bottom, sides, divider, and shelves extend the plywood parts by ¼". This ensures alignment. Now, cut the shelf cleats to size.





3 Apply edging where shown, and the same finish or paint used on the plywood parts. Attach the shelf cleats using #8×¾" screws.

4 Assemble the cart using #8×2" screws, as shown. You may want a friend to help move the configuration and steady the large pieces. We found it easiest to install the shelves between one side and the divider, and then add the back, top and bottom, and final side. When done, install 3" swivel casters, where shown.

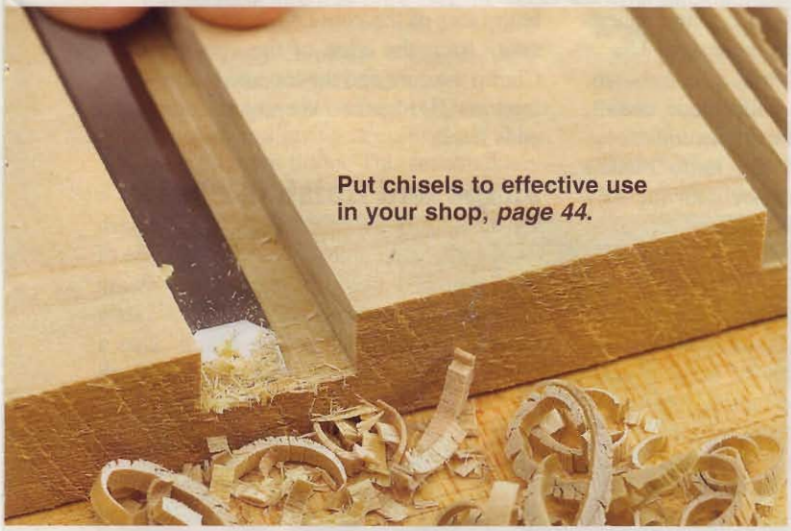
Project designs: **Board Bunks: Jeff Mertz Scrap Sorter, Sheet Goods Storage Cart: Jerry Lenz, Elizabeth, Colo.**

SPECIAL SECTION

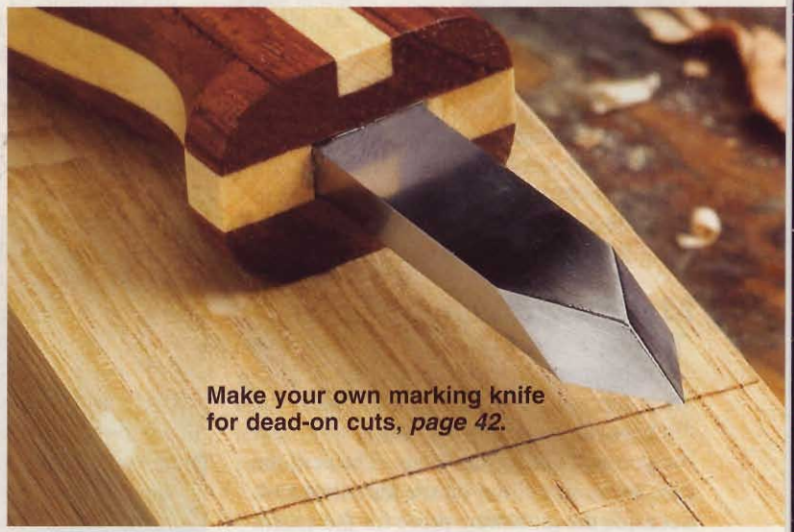
hand tool handbook

Like you, we love our power tools. But certain workshop tasks are still best accomplished through more traditional means. In this section learn the keys to using, choosing, and sharpening four indispensable hand tools.

See everything you need to know about block planes, *page 48.*



Put chisels to effective use in your shop, *page 44.*



Make your own marking knife for dead-on cuts, *page 42.*

Get glass-smooth results with hand scrapers, *page 46.*

Hone razor-sharp edges with Japanese water stones, *page 54.*

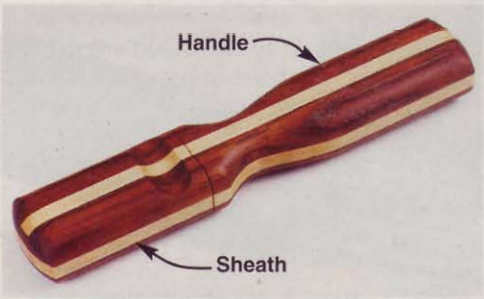
fine-line marking knife

Nothing beats a crisp scribed line for accurate layout.

With the flat back of its blade against a straightedge, you can use this marking knife to lay down cutlines with pinpoint accuracy. When not in use, a hidden magnet keeps the blade sheath safely in place. This fine tool is one you'll be pleased to use and proud to show. For the special materials needed to make this marking knife, see **Source**.

Make a laminated blank

1 From a ¾×1×12" piece of stock (we used maple), resaw and plane a 3/16"-thick piece for the core (A). Check the thickness against the 3/16"-thick tool-steel bar you will use for the blade. Then cut the core to the size listed on the **Materials List**. Set aside the remaining piece for the accent strip (C). Make a copy of the core pattern on the *WOOD Patterns*® insert, and adhere it to the part with spray adhesive. Use a Forstner bit to drill a ¼" hole, where shown, and then scrollsaw the knife blade cutout. (The ¼" semicircle makes room for excess epoxy when mounting the knife blade.) Check the width of the slot with the ⅜"-wide tool-steel bar.



To ensure perfectly matched grain from handle to sheath, glue the knife up as a single blank, and then cut it into two pieces.

2 From a ¾×1×12" piece of stock (we used bubinga), resaw and plane a ¼"-thick piece for the top and bottom laminations (B). Then cut the laminations to size. Use a Forstner bit to drill a ⅜" hole ⅛" deep for the magnet in the top lamination, where dimensioned on the drawing, *opposite*. Make sure the magnet does not protrude beyond the surface.

3 Install a zero-clearance insert in your tablesaw, and cut a 3/16" groove ⅛" deep centered in the top lamination (B) for the accent strip (C), as shown in **Photo A**. Check the fit of the 3/16"-thick stock left from making the core (A). Then rip a 5/32"-wide strip from the edge of the leftover 3/16" stock, and glue and clamp it in the groove. Sand the strip flush.

4 Epoxy the magnet in the ⅜" hole in the top lamination (B), and let it cure. Remove any excess epoxy with a chisel. To keep track of the magnet end, make a mark over the magnet on the top surface of the lamination. Now spread glue sparingly on both faces of the core (A), keeping the glue away from the edge of the center cutout. Clamp the core and the top and bottom laminations (B) together, keeping the edges and ends flush.

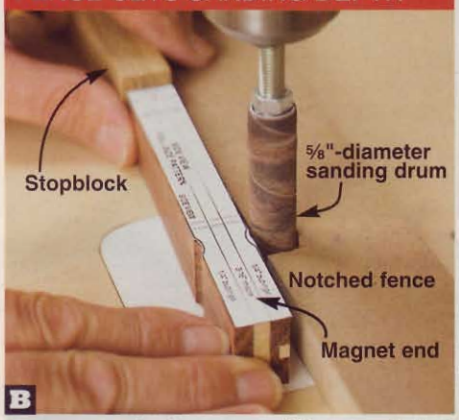
Shape and finish the knife

1 Make a copy of the side view pattern on the insert and adhere it to the edge of the laminated blank, orienting the sheath end of the pattern with the previously marked magnet end of the blank. Use a ⅝"-diameter sanding drum and stopblock

SAFELY CUT A SMALL PART

Cut a 3/16" groove ⅛" deep in the top lamination (B) in two passes. Turn the part end-for-end between passes to center the cut.

FENCE SETS SANDING DEPTH



Adjust a notched scrapwood fence so 1/16" of the drum protrudes and sand the recesses.

TWO FINAL STEPS TO A COMPLETED KNIFE

Using a thin stick, apply a small amount of epoxy to the inside of the handle opening.

With the blade point bearing on a scrap block, push the handle down to the masking tape.

to form the finger recesses, as shown in **Photo B**. Remove the pattern.

2 Make a copy of the top view pattern on the insert and adhere it to the laminated blank with spray adhesive. Saw and sand the handle edge profiles, and sand the end arcs. Remove the pattern.

3 Chuck a ¼" round-over bit in your table-mounted router and rout all the edges. Finish-sand the laminated blank.

4 To separate the sheath from the handle, cut the blank where indicated on the top view pattern and the drawing, *below*. To prevent chipping when cutting the blank, see the **Shop Tip** at *right*.

5 From a 3/16×⅜×6" bar of grade W-1 tool steel, make a blade, as instructed in the article on *page 14*. Clamp the blade in a vise between two pieces of scrapwood, and cut it to 3½" long with a hacksaw. Wrap masking tape around the blade to mark the 1½" length that will protrude from the handle. Install the blade in the handle, as shown in **Photos C** and **D**. Remove any excess epoxy with acetone.

6 Apply a clear finish. (We wiped on three coats of Watco Natural Danish Oil Finish, following the instructions on the can.) With the finish dry, align the accent strip and slide the sheath onto the blade.

Written by **Jan Svec** with **Chuck Hedlund**
Project design: **Jeff Mertz**
Illustration: **Roxanne LeMoine**

Materials List

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A* core	3/16"	1"	5⅝"	M	1
B* top and bottom laminations	¼"	1"	5⅝"	B	2
C* accent strip	⅛"	3/16"	5⅝"	M	1

*Parts initially cut oversize. See the instructions.

Materials key: M–maple, B–bubinga.

Supplies: Spray adhesive, epoxy.

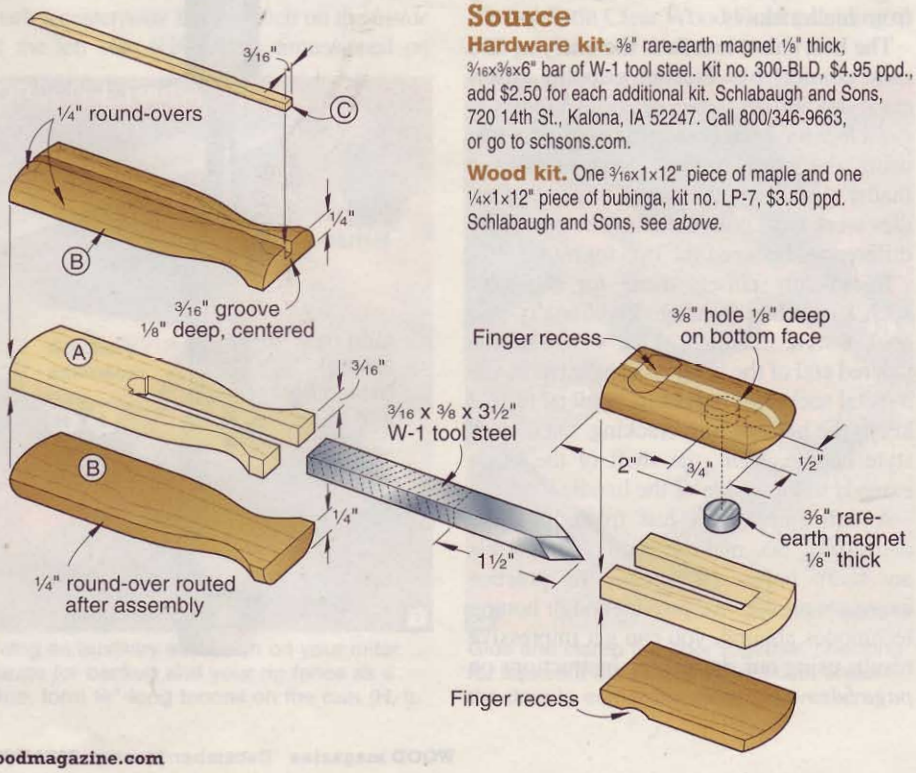
Bits and accessories: ¼" and ⅜" Forstner bits, ¼" round-over router bit, ⅝"-diameter sanding drum.

Source

Hardware kit. ⅜" rare-earth magnet ⅛" thick, 3/16×⅜×6" bar of W-1 tool steel. Kit no. 300-BLD, $4.95 ppd., add $2.50 for each additional kit. Schlabaugh and Sons, 720 14th St., Kalona, IA 52247. Call 800/346-9663, or go to schsons.com.

Wood kit. One 3/16×1×12" piece of maple and one ¼×1×12" piece of bubinga, kit no. LP-7, $3.50 ppd. Schlabaugh and Sons, see *above*.

EXPLODED VIEW



SHOP TIP

Prevent chipping when making critical cuts

When separating the marking knife sheath from the handle, you get only one chance to make a perfect cut. Chip-out will be impossible to hide. To guarantee success, install a fine-tooth blade and a zero-clearance insert in your tablesaw. Then, to back the cut, attach an auxiliary extension to the miter gauge. Wrap masking tape around the blank centered 2" from the magnet end, and mark the cutline. Then to keep the crosscut perfectly square, wrap masking tape around the blank near both ends. Align the cutline with the blade and clamp a stopblock to the extension to prevent the blank from shifting during the cut. Apply double-faced tape to the extension and stick the blank to it. Now make the cut, as shown *below*.

chisels
practice makes perfect

The more you learn about how to use chisels, the more uses you'll find for them.

Whether the job calls for cleaning up a mortise, crafting a dovetail joint, or just shaving off a dried glue glob, chisels remain the tool to choose for these and other workshop tasks.

Chisels come in specialized sizes and designs. However, unless you need short and small chisels for woodcarving or large framing chisels that are rugged enough to be hammered into posts and beams, the type you'll reach for most is a *bevel-sided firmer chisel*, like those pictured here.

Your chisel choices

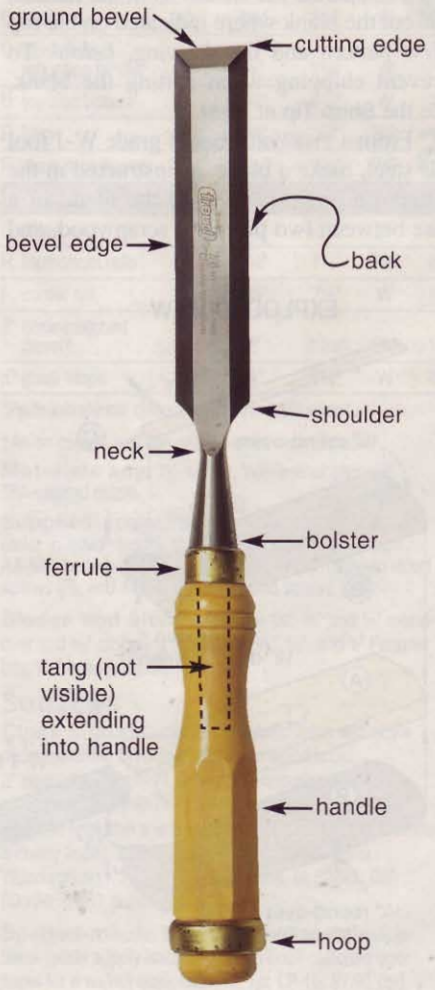
You can buy most types and brands of chisels individually or in sets of different widths, usually ¼–1" wide. For detail work, such as closely spaced dovetails, you'll also want a ⅛"-wide chisel. If you're doing large mortises, a chisel 1¼–2" wide helps you cut clean, even sides.

Most bevel-edge chisels have 24–31° cutting bevels. Bevels are angled to suit the type of work the chisel was designed to do. The cutting 27° bevel of a mortising chisel, like the one shown *left top*, is steeper than the 24° bevel of the bevel-edge chisel, shown *left bottom*, to reinforce the cutting edge and keep it from blunting or breaking from mallet blows.

The best chisel handle is the one you find most comfortable. Practice gripping different styles and diameters of chisel handles to get a feel for what best fits your hand while using the chisel either alone or with a mallet. As for whether wood or plastic handles work best, our tests show no durability differences between the two for most jobs.

Heavy-duty chisels made for big jobs, such as timber framing, traditionally had socket-style handles. That's where the tapered end of the wooden handle fits inside a metal socket on the blade. A metal ferrule keeps the handle from cracking. On a tang-style handle, *right*, the shaft of the blade extends to the inside of the handle.

A dull chisel isn't just frustrating, it's dangerous. So, make certain your chisels are sharp before attempting the practice exercises on the *next page*. Though honing techniques abound, you can get impressive results using our sharpening instructions on *page 54*.



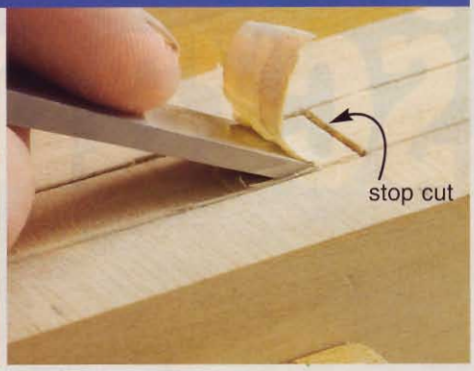
Skill Builders

MAKE A CLEAN MORTISE

Here's a four-step method for creating a mortise using a ½" and a 1" chisel. Normally, you'd drill holes down the length of your mortise and flatten the sides and square off the ends with your chisels, but the following procedure is meant to be strictly for practice.

1 Mark off your practice mortises on the edge of a piece of scrap lumber so their width is slightly greater than the width of the chisels you're using. For this exercise, scribe mortises about ½" wide by 2" long. Clamp your practice scrap firmly in your bench vise so the top edge is parallel to the benchtop. Add a support block underneath to keep it from shifting, if necessary.

2 Define the sides of each mortise using either a utility knife or a mortise marking gauge. With your chisel perpendicular to the wood's surface and the bevel facing the waste side, use a mallet to make a pair



of stop cuts about ⅛"-deep across the grain at the ends of the mortise. Then, using your widest available chisel, make ⅛" deep cuts with the grain into the mortise sides, as shown *above left*.

3 Brace the chisel close to the end for control, as shown *above right*, and use your other hand to drive the chisel between the edges of the mortise. Shave, don't pry, the wood until you reach your stop cuts. Your goal is to develop precise control over the movement of the chisel.

4 Create a new set of stop cuts on all four sides and shave away the waste between the cuts. Repeat this routine until the mortise is at least 1½" deep, and then move on to the next one. The mortise walls should be smooth and vertical.

CLEAN UP A DADO

If you don't have a dado set for your tablesaw or radial-arm saw, a chisel can clean out waste between multiple saw cuts when fine-tuning a dado. For practice, we cut ½"-wide dadoes about two-thirds of the way through the thickness of the wood and then removed part of the waste using the saw.

1 With the chisel's bevel side down, make shallow slices to determine the direction of the grain. (The chisel will want to follow the path of the grain.)

2 Cut in the direction where the grain pushes the blade upward. If you feel the chisel being pulled downward into the wood, you're going in the wrong direction. Use a mallet if you need extra cutting power when working with hardwoods, but switch to shallow, two-handed slicing cuts

as you near the bottom of the dado. Practice making long slices until you're nearly to the bottom of the saw kerfs, as shown *above left*. Work slowly until you get a feel for how the chisel handles both with and without a mallet.

3 Flip the chisel over and use the flat back to clean and level the cut, making it smooth and flush with the bottom of the saw kerfs, as shown *above right*. Work carefully around the edges to avoid tearing out the wood there.

FLUSH-CUT WOOD PLUGS

Chisels excel at this simple task, leaving a smooth surface that's ready to sand. For practice, we glued a handful of plugs into a piece of oak scrap. Wait until the glue dries before you begin practicing. For this exercise, use a chisel wider than your plug.

1 With the chisel held bevel side down, shave a slice of the topmost part of the plug to determine its grain direction, as shown at *right*. Again, you'll want to cut in the direction where it feels like the grain is pushing the chisel upward instead of pulling it down into the surface of the scrap. If you cut in the other direction, the plug could split off beneath the face of the wood.

2 With the plug shaved to just above the surface, flip the chisel over with the bevel side up and press the chisel back firmly against the face of the scrap. The flat back of the chisel will keep the blade from digging into the wood as you shave away the rest of the plug flush with the surface of the wood face, as shown *above right*.

get hooked on scrapers

Spend a few minutes mastering hand scrapers and you'll save hours of sanding.

There's no high-tech here—no electric motors, no batteries, not a single moving part. Scrapers are just a flexing, flat sheet of metal—a tool that's been used for centuries to remove thin layers of wood and leave a burnished surface that's nearly ready to finish after just light sanding.

A tiny hook along the edge (called a burr) acts like a tiny plane, shaving just a wisp of wood from the surface. A scraper's delicate cut makes it invaluable for smoothing inlays, spots where wood grains run in different directions, and woods with hard-to-plane grains, such as cherry.

Regardless of the wood type, scrapers excel at removing planer marks and, using a curved-edge scraper, some router ripples on moldings. On flat surfaces, a scraper lets you skip ahead to a 220-grit or higher abrasive using a random-orbit sander.

Start with a scraper that's about .032" thick. The thickness of the metal determines the size of the burr you'll create along the edge. Thin scrapers yield finer burrs that won't damage delicate inlays. Thick scrapers remove more wood with each pass.

Most rectangular scrapers cost less than $4. We obtained a $12 set of four scrapers (item 05K30.10) in different thicknesses from Lee Valley Tools (800/871-8158 or leevalley.com). A set of curved scrapers—ideal for concave or convex surfaces—runs about $10 (item 05K20.10). If you have a mill file, sharpening stone, and an old ½" drill bit or tool with a hardened, round shaft to use as a burnisher, you're all set.

Scraping along

Scrapers can be pushed or pulled. Pushing makes it easier to flex the blade with your thumbs as you work. Avoid bending the scraper too much or you'll create a washboard of shallow depressions in panels or wide boards. Pulling gives you added control and makes it easier to see what sort of shavings you're making. Your best bet is to practice both techniques until you decide what feels right. Either way, always lift the blade from your workpiece as you reposition the scraper for the next stroke.

Check the waste left behind by your scraper as you work. You should see tiny curls like the ones shown *above* when pushing the scraper and what look like lacy layers of wood on a diagonal pull stroke. If all you're making is sawdust, increase or adjust the angle of the burr or the angle you're holding the scraper.

Practice will teach you the best angle for scraping. Try this for starters: Hold your sharpened scraper 90° to the wood surface. Lightly pull or push it with little downward pressure and slowly tilt the scraper in the direction it's moving until you feel the burr start to bite into the wood. Surprise, it takes only a slight angle before the burr starts to catch on the wood, and just a bit more angle before you start making curls.

Your scraping technique will need to change slightly with each use because the burr angle changes a bit every time you burnish the edge and as it wears. Consistently position yourself next to your workpiece so you can make the longest strokes possible. Avoid short scraping strokes like those you'd make with a paint scraper.

Hone 'em and hook 'em

Scrapers are no harder to sharpen than a plane blade or chisel, and there's a bonus: You can create four fresh burrs at each sharpening session.

1 New scrapers may have perfectly machined edges ready to be burnished. Eventually, though, you'll need to square off both long edges before burnishing them. First, flatten the old burr by lightly rubbing the faces of the scraper with a medium-grit sharpening stone about ½" from the edges, as shown *below*.

FLATTEN THE OLD BURR

2 With the scraper clamped in a vice, file the edges flat and straight. We cut a ⅛" deep rabbet into an oak scrap roughly ¾×1½×4" to brace the file so it would ride flat along the edge, as shown *below*.

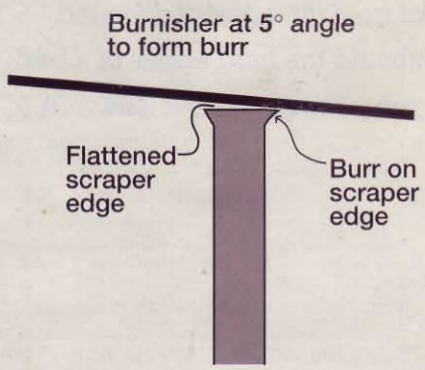
SQUARE UP THE EDGES

3 Any rod of hardened steel can serve as a burnisher. We used the neck of a chisel (with a protective cap on the cutting edge for safety). A round screwdriver shaft, an old ½" drill bit, or a burnishing specialty tool also works. Start by securing the scraper tightly in a vice between two blocks so that no edges are being pressed into the blocks or the sides of the vice. Press the burnisher firmly against the scraper edge, as shown *below*, and draw it along the length of the edge until you feel a consistent lip start to form along both sides of the edge

BURNISH A BURR

4 Create an angled burr by riding the burnisher along both sides of the edge at a 5° downward angle, as illustrated *below*. It's better to make several passes using moderate pressure than try to form a burr in a single pass. A 5° angle handles most scraping jobs. Use less angle for fine scraping and up to 10° for heavy work. To turn a scraper into a multi-purpose tool, create different angles on different edges.

SETTING THE BURR ANGLE



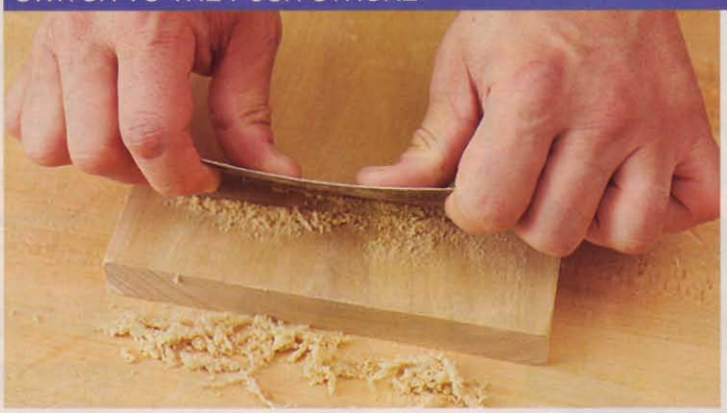
Skill Builders

MASTER THE PULL STROKE

Grip the scraper with your fingers pressing against the center in back and your thumbs gripping the left and right edges. Press the back with your fingers to flex the scraper slightly so that the center touches the wood but the corners don't dig in. Pull the scraper toward you, experimenting with the angle until you consistently remove a surface layer in curls. After you master this basic pull stroke, hold the cutting edge at an angle, as shown at *lower left*, as you pull it toward you. This sheering action produces long, thin ribbons of wood and leaves a light surface sheen.

Curved scrapers, such as the one at *lower right*, can be used in combinations to smooth a wide variety of molding profiles and curved workpieces.

SWITCH TO THE PUSH STROKE



Now try scraping on the push stroke. Hold the scraper at the edges and this time use your thumbs to give it an outward bowing flex, as shown at *left*.

SEE WHAT YOU'RE SCRAPING

Using a broad pencil, make wavy lines along the width and length of a piece of scrapwood. Practice making end-to-end passes with your scraper. The pencil marks show how wide a path your scraper makes on both the push and pull strokes, as shown at *right*. This exercise also shows the amount of material removed with each pass and whether you've made an even burr along the scraper's edge. Scrapers work both with the grain and perpendicular to it, so practice scraping both ways on your scrap.

block planes

The first hand tool every power-tool woodworker needs

During the past 100 years, the block plane has remained essentially unchanged in form and function. It's a compact and rigid one-handed plane capable of producing whisper-thin wood shavings. Whether removing milling marks from the edge of a jointed board, trimming the end of a tenon, or softening the hard edges of a bed post, the diminutive block plane serves even power-tool devotees well.

Part 1: Three jobs a block plane does better than a power tool

Tools with motors cut faster and with less effort than many hand tools, to be sure. But the quiet and simple block plane performs some tasks better and faster without all the racket.

1 Smoothing end grain. You won't believe how glass-smooth your cross-grain cuts (such as dovetails, box joints, and tenons) can be until you've sliced them clean with a sharp block plane. Power-tool crosscuts in hardwoods can burn (as shown in the photo, at *left*) and softwoods may fuzz. Trying to sand away those imperfections causes even more fuzzing.

To clean up end-grain cuts, secure the workpiece in a vise with the end grain up. It's easy to blow out the end of the cut as the plane exits the workpiece, so clamp on a scrapwood backing board or slightly chamfer the trailing edge before making your first cut. Cut shallow on end grain; you should be able to peel off a thin shaving like the one shown at *right*. If the plane chatters across the cut, sharpen the blade and/or back out the blade slightly.

NOW THAT'S A CLOSE SHAVE

Don't try to remove too much wood at once when planing end grain. This translucent walnut shaving is just about perfect.

2 Planing edge grain. Think a jointer gives you a perfect gluing surface? Think again. Any rotating cutter, including router bits and a power planer, creates a series of closely spaced scallops, as shown at *near right*. A few quick strokes with a block plane levels those peaks and valleys into a truly smooth surface for gluing (*far right*).

Obviously, wood cuts easier *with* the grain than *across* it, so you can cut a little deeper in this situation. If your block plane has an adjustable throat opening, close it so just a sliver of light peeks between it and the blade. Without this limitation, the knife tends to "dive" into the grain and then bounce back up, breaking off the shaving and leaving the wood with a rough surface.

FROM SCALLOPED TO SMOOTH IN THREE EASY STROKES

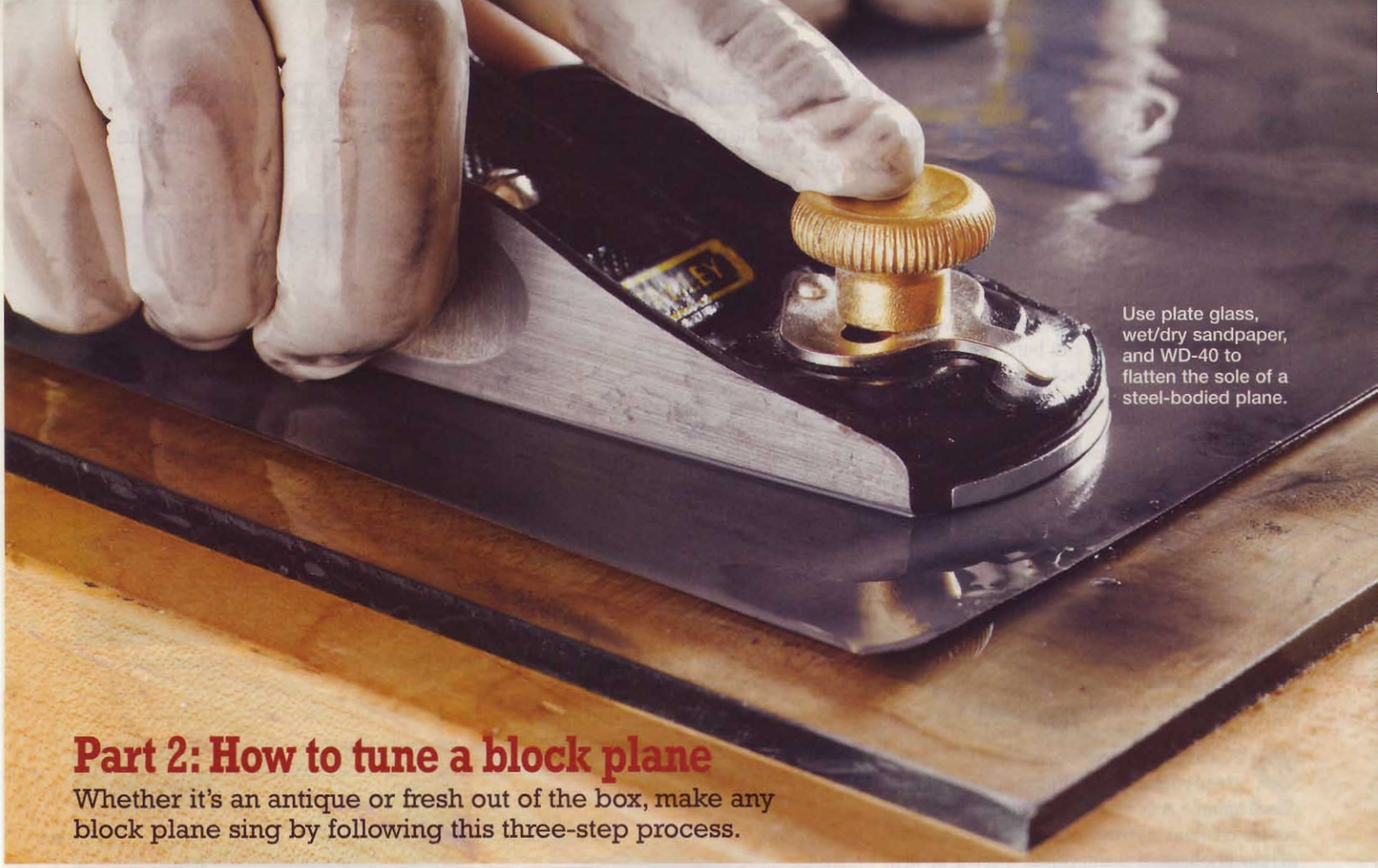
Looking close up at the edge of this power-jointed board (left) reveals a not-so-smooth surface that can weaken a glue joint. A few shallow passes with a sharp block plane removed the scallops and left a noticeably smoother edge (right).

3 Chamfering. To soften the sharp edge where two adjoining faces meet on, say, a table leg or bed post, you might be tempted to reach for your router or a sanding block. By the time you *find* your chamfering bit (much less install it), you could have knocked off those hard edges with a block plane with less effort and smoother results than sandpaper. Not only is a block plane faster, but it also can chamfer in ways power tools cannot, such as creating a tapered or asymmetrical chamfer.

Simply breaking an edge requires no special instructions: Set the plane's cutting depth for a light cut, then make a few passes holding the plane at about a 45° angle to one face of the workpiece. For wide, tapered, or asymmetrical chamfers, draw layout lines, as shown at *right*, then gradually plane down to the lines.

LIVING ON THE EDGE

Draw layout lines to define the limits of the chamfer on a table leg. As you plane, adjust the angle of the tool on the table leg as needed to meet the lines.



Use plate glass, wet/dry sandpaper, and WD-40 to flatten the sole of a steel-bodied plane.

Part 2: How to tune a block plane

Whether it's an antique or fresh out of the box, make any block plane sing by following this three-step process.

Most first-time plane users get discouraged by their initial attempts at using the tool because they try to remove too thick a shaving with a dull blade. Truth is, all hand planes—even the brand new ones—need a little TLC before they'll cut properly. A well-tuned plane glides across your workpiece, leaving a super-smooth surface, ready for finishing.

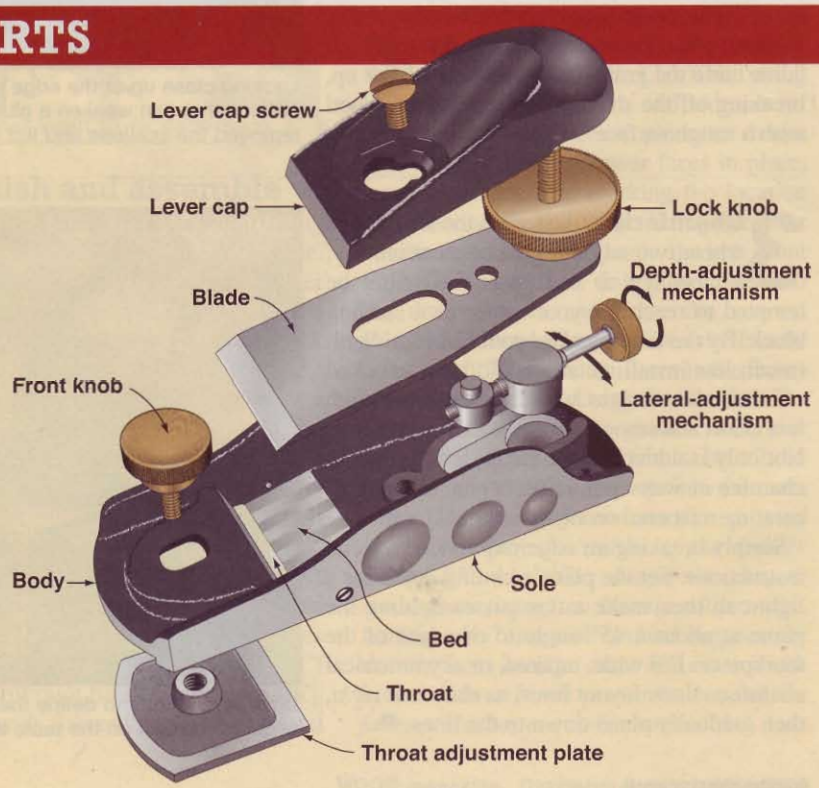
Before you begin your tune-up, disassemble the plane and inspect it for any missing or damaged parts (see the drawing *below*) or rough areas left over from the manufacturing process. Replace parts if necessary, and file rough areas smooth. Once you're satisfied, reassemble the tool, including installing the blade.

KNOW YOUR PLANE PARTS

This drawing shows the anatomy of a typical block plane, although the specific adjustment mechanisms may differ depending on the model.

The *body* comprises the *bed*, which establishes the angle between the *blade* and the *sole*—the flat bottom of the body. Many block planes have a *throat adjustment plate* that slides forward or backward to control the amount of material the plane removes with each pass. The *front knob* serves two purposes: to secure the throat adjustment plate on planes so equipped and to provide a place for your index finger (or other hand) for better control.

A hole (or sometimes a notch) in the blade engages the *depth-adjustment mechanism*. Turning the knob clockwise projects the blade farther through the sole causing the plane to cut deeper; counterclockwise rotation withdraws it. To ensure that the cutting edge of the blade parallels the sole, a *lateral-adjustment mechanism* rotates the blade slightly on the bed. The *lever cap* secures the blade to the bed with help from the *lock knob* (or *lock lever*, on some planes).



1 Save your sole. The sole of a plane must be perfectly flat to ensure good results, and the smoother you can make it, the less friction you'll have to overcome when using it. Flattening (or *lapping*) the sole can take hours, depending on the condition of the plane, so stick with it and you'll be rewarded with a plane that practically sails across the wood.

For this step, you'll need a piece of plate glass at least 10×10" (we paid about $10 for a 1' square of ¼" plate at a local glass outlet); automotive wet/dry sandpaper sheets in grits 180, 220, 320, and 600; and a light-duty lubricant (we use WD-40). To keep the black slurry from getting under your fingernails, don a pair of inexpensive latex gloves.

A plane's body changes shape slightly depending on whether the lever cap is tightened, so lap the sole in the tightened state. Before you begin, retract the blade into the throat of the plane at least 1/32", then secure the lever cap snugly.

Place a sheet of the 180-grit abrasive on the plate glass, then generously wet it with lubricant. Holding the paper on the glass with one hand, grip the plane as shown in the photo at *left* and slide the tool forward and backward using moderate hand pressure. To get the most out of the abrasive, use the full width of the paper equally as you lap.

After a few minutes of lapping, turn the plane over, wipe it with a cloth or paper towel, and examine the sole. You should see some shiny areas and others that appear dull, as shown *above right*. Continue lapping, rotating the sandpaper and the plane body 180° about every 10 minutes to cancel any unintentional left-to-right bias. Add more lubricant to keep the abrasive wet, and change paper as needed. When the sole appears uniformly shiny, you know it's flat.

The job isn't quite yet done, however. Repeat the lapping process using progressively higher grits until the sole looks highly polished. This step won't take nearly as long as the initial flattening.

A GOOD START AT LAPPING

The shiny surfaces of this sole have been sanded flat after about three minutes of lapping. It'll take many more strokes to flatten the dull, dished-out areas.

2 Sharpen the blade. Make no mistake—the most important part of a hand plane is its razor-sharp blade. No matter how well you tune the rest of the tool, you'll be disappointed if you try to cut with a dull blade. Remove the blade from the plane body and sharpen it using your favorite method. If you haven't done much sharpening, check out "Hone Super-Sharp Edges With Waterstones" on *page 54* for a fast way to put an edge on your cutting tools. Just keep these points in mind:

■ ***Sharpen early.*** Even a brand new plane blade needs to be sharpened, so don't expect to get perfect results right out of the box. Know, too, that because of the way plane blades are manufactured, a new blade may dull rapidly at first, perhaps within 10–15 strokes. Hang in there: After several sharpenings, it will begin to hold its edge much longer.

■ ***Sharpen often.*** Don't wait until the tool starts to chatter like a Model T on a cobblestone road before you sharpen the blade. At the first sign of dulling (you'll start to feel like you're forcing the blade through the wood), pull it out and sharpen it. You'll find it faster and easier to clean up an edge that's still fairly sharp.

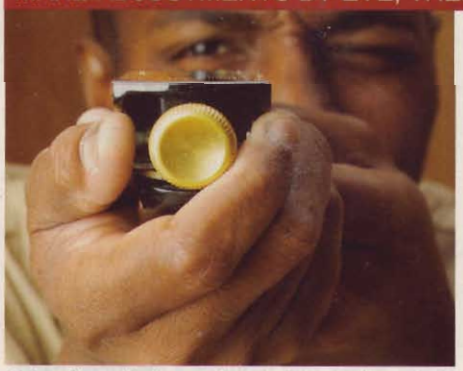
■ ***Stick with one bevel.*** Some sharpening gurus suggest that adding a microbevel (a slightly steeper bevel at the edge of the primary cutting bevel) lengthens the life of a sharp edge, and it can. But for accuracy and controlled planing, you can't beat a true single bevel.

3 Assemble and adjust. Install the sharpened blade in your plane with the lever cap screw (or lever) loose enough to allow blade movement, and snug enough to prevent the blade from falling out. Block plane blades go in with the bevel up, rather than down like other planes, and the depth-adjustment mechanism should engage the notch or hole in the bottom of the blade.

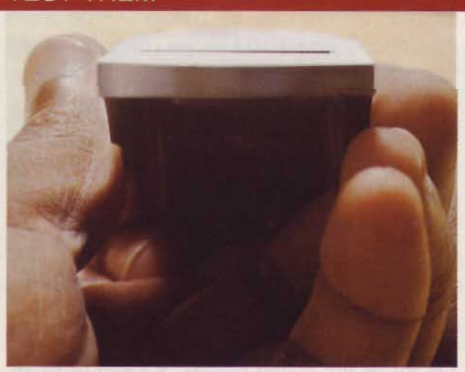
Holding the plane as shown *below*, sight down the sole and turn the depth-adjustment mechanism until the blade is at its maximum cutting depth. (On planes with an adjustable throat plate, you may also need to open the throat completely.) Now, still eyeballing down the sole of the tool, use the lateral adjustment mechanism—or your fingers if your block plane lacks this mechanism—to make the cutting edge parallel to the sole. (See photo *below*.)

Now retract the blade into the plane body until it appears as a barely visible shadow when sighting down the sole. Lock the blade by tightening the lever cap screw, then make a test cut in the edge grain of a scrap of soft wood. If the plane brings up only a smattering of wood dust from the edge, set the cut a little deeper by unlocking the blade and rotating the depth-adjustment mechanism ⅛ turn. Make another test cut, and repeat the process until you pull up a nice thin shaving, as shown *below*. A plane set to cut too deep requires a fair amount of force and yields a thick, stiff shaving. Retract the blade ⅛ turn and try again.

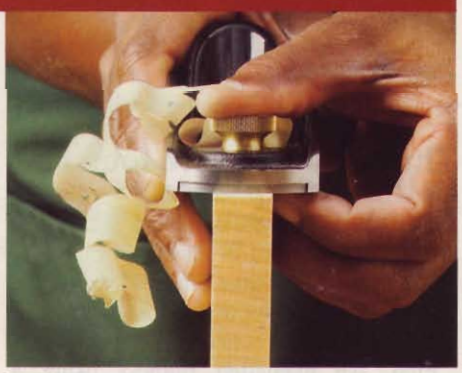
MAKE ADJUSTMENTS BY EYE, THEN TEST THEM



Bring the sole to eye level when making blade adjustments. Looking into the front of the plane gives you a good view.



This blade is set a little too deep and needs to be rotated slightly because the right edge is higher than the left.



With a good sharp blade set properly, you should be able to shear off a gossamer-thin shaving in edge grain and end grain.

Part 3: How to buy the right low-angle block plane

Now that we've sold you on the idea that even power-tool woodworkers should own a block plane, you're probably ready to run out and buy one. Not so fast: Make sure you get a low-angle model. (See box on the *next page*.) Although they look similar, we found key differences between today's models, and as is often the case, the difference is in the details.

Three qualities we found in the great planes

■ ***Flat sole.*** The sole of a block plane must be flat, as described in Part 2. Because we prefer to spend our time using planes instead of preparing them for use, the flatter the sole out of the box, the better.

First, we eyeballed flatness using a machinist's straightedge against each plane's sole, then looked for light between the two. The Anant 60½ and the Stanley 12-960 had obvious imperfections.

But the true test of flatness came when we lapped the soles of all the planes (as shown on *page 51*), a process that revealed even minute differences in flatness. The Lie-Nielsen 60½ and 102 shone (literally) after only a few minutes of lapping, with the Veritas 05P22.01 and 05P27.02 nearly as flat. It took more than two hours of lapping to make the lower-priced Anant and Stanley planes acceptable.

■ ***Easy, accurate blade adjustments.*** This performance area includes setting the cutting depth, adjusting the blade *cant* (rotation of the blade to make the cutting edge parallel to the sole), and locking the blade. On all of the tested planes, a knob turns in and out to set the blade deeper or shallower, and all were easy to use.

We did, however, find big differences in the each tool's *backlash* (the amount you have turn the knob before it advances or retracts the blade). The Anant scored worst with ¾-turn of backlash; the Veritas planes scored best, requiring only ⅛ turn until the blade moved.

The Veritas planes also use a single pivoting arm to adjust both the cutting depth and blade cant. Swinging the Veritas planes' depth adjustment mechanism to the left or right rotates the blade. We prefer the precision of this system to the somewhat sloppy lateral-adjustment systems found on the Anant and Stanley. The Lie-Nielsens lack a lateral-adjustment mechanism; fine-tuning is done manually by shifting the blade, a task that requires a practiced hand.

Once adjusted, you must lock the blade in place, and Stanley's lever lock is the most

Why a low-angle plane?

Good question. All of the tested planes use a blade that's ground to a 25° bevel and held in the tool at an angle of about 12°. Combined, that places the cutting angle at about 37°, compared to a standard block-plane cutting angle of 45°. (See photo *below*.) The standard angle works well in face grain and edge grain because it's easy to part the soda-strawlike wood fibers.

On a low-angle block plane, the shallow cutting angle helps the blade cut more efficiently in end grain. Yet, it still cuts well going with and across the grain, making it the more versatile of the two styles.

THE ANGLE OF ATTACK AFFECTS CUTTING PERFORMANCE

These two Lie-Nielsen block planes are identical except for the cutting angles: The standard-angle 103 (left) and the low-angle 102 (right).

This man speaks the plane truth

Tool tester/technical consultant Tim Peters heads the woodworking department at Orange Coast College in Costa Mesa, California. A master woodworker for 24 years, Tim's collegiate program focuses on teaching proper hand-tool use to woodworkers of all skill levels.

difficult to use while holding the blade in position. Anant's small lock knob inside the lever cap is a bit better, but we like the large thumbwheel on the Lie-Nielsen and Veritas planes.

■ ***Thick blade.*** When the going gets rough, a thick blade resists flexing (and thus chatter) better than a thinner blade. The blades of the Anant and Stanley planes measured about 30 percent thinner than the rest of the tested planes, which contributed to their lower cut-quality.

The top guns in our plane test

By the time the shavings had settled, the Lie-Nielsen 60½ emerged as our Top Tool. Whether planing end grain, edge grain, or chamfers, in both hardwoods and softwoods, we kept coming back to this clean-cutting tool. It proved virtually dead-flat out of the box and just feels right in our hands: substantial without being cumbersome to use for an extended period. Although we wish the Lie-Nielsen 60½ had a lateral-adjustment mechanism, we found the adjustments easy and the blade lock secure.

For less than half the price, the Veritas 05P27.02 performed nearly on par with the Top Tool, making it our Top Value. Though smaller and lighter than many of the other tested planes, the nicely machined 05P27.02 tucks neatly into an apron pocket, and its combination blade depth/lateral adjuster is a joy to use. 🌳

Written by **Dave Campbell** with **Tim Peters**

THE LOWDOWN ON SIX LOW-ANGLE BLOCK PLANES

BRAND	MODEL	SOLE DIMENSIONS (WxL, INCHES)	ADJUSTABLE THROAT? (YES, NO)	BLADE WIDTH (INCHES)	BLADE THICKNESS	BLADE LOCKING STYLE (1)	LATERAL-ADJUSTMENT MECHANISM (2)	PERFORMANCE GRADES (3)										COUNTRY OF ASSEMBLY (4)	WEIGHT (OUNCES) (5)	SELLING PRICE (6)	FOR MORE INFORMATION:	
								SOLE FLATNESS	EASE OF ADJUSTING CUTTING DEPTH	EASE OF ADJUSTING THROAT OPENING	EASE OF ADJUSTING BLADE CANT	EASE OF LOCKING BLADE	END GRAIN	CUT QUALITY: EDGE GRAIN	CUT QUALITY: CHAMFERING	CUT QUALITY: FIT AND FINISH	TOOL BASE				CALL	CLICK
ANANT	60½	1¾ x 6¼	Y	1⅜	.081"	S	L	C	D	D	D	C	C	B	B	C	C	I	23.8	$35	800/356-2195	rlarson.com
LIE-NIELSEN	60½	1¾ x 6¼	Y	1⅜	.128"	W	M	A	B	A	B	A-	A	A	A	A	A	U	26.4	150	800/327-2520	lie-nielsen.com
	102	1½ x 5¼	N	1¼	.122"	W	M	A	B	N/A	B	A-	A	B	A	B	B	U	15.4	95		
STANLEY	12-960	1¾ x 6¼	Y	1⅜	.084"	L	L	C-	C	D	D	D	C	C	C	D	C	E	23.5	45	860/782-6539	stanleyworks.com
VERITAS	05P22.01	2 x 6⅜	Y	1 9/16	.128"	W	P	A-	B	B	C	A-	B	B	B	B	B	C	28.0	100	800/871-8158	leevalley.com
	05P27.02	1⅝ x 5½	N	1 3/16	.128"	W	P	A-	A	N/A	A	A-	A	B	A	A	B	C	15.3	74		

NOTES:

1. (L) Lever
   (S) Thumbscrew
   (W) Thumbwheel
2. (L) Lateral adjusting arm
   (M) Manual
   (P) Pivot arm
3. A Excellent
   B Above average
   C Average
   D Below average
   N/A Throat not adjustable
4. (C) Canada
   (E) England
   (I) India
   (U) United States
5. Including blade
6. Prices current at time of article's production and do not include shipping, where applicable.

hone super-sharp edges with waterstones

Used as a group, these four stones can restore an edge to even badly abused chisels.

When was the last time your chisels and planes cut through wood like butter? Never? Follow Tim Peters' expert advice and create razor-sharp tool edges primed for peak performance.

Precision woodworking requires tools with a keen edge. So when woodworking instructor Tim Peters needs a plane or chisel able to effortlessly skim fine curls from a board, he uses a sharpening system that leaves an absolutely flat, razor-like, mirror-finish edge.

The key to his system is a combination of four Japanese waterstones. These synthetic sharpening stones consist of fine abrasive particles, such as natural clay and carbide, molded into blocks with a ceramic binder.

Peters, a master woodworker for 24 years, heads the woodworking department at Orange Coast College in Costa Mesa, California. After years of experimenting with hundreds of dollars in sharpening stones from different manufacturers, he has settled on the following four:

- A 700-grit Bester stone for removing grinding marks left behind when the tool was made or reground.
- A 1,200-grit Bester stone for intermediate honing to remove the marks left by the previous stone.
- A 2,000-grit Shapton stone to begin the edge polishing process.
- A 8,000-grit Takenoko stone to give bevels a mirror edge.

(For WOOD® magazine readers, Hida Tool and Hardware Co. is offering a collection of all four stones for a special discounted price of $165 through 2004. See Sources on page 56 for details.)

Each stone is essential to the sharpening process. Bypassing the intermediate stones creates the same problem as skipping sandpaper grits: You'll work longer with the fine-grit stone to remove the tiny scratches left by coarser stones than if you had progressed from one stone to the next.

Accessories to have on hand before you begin include a container of water for soaking the stones, clean rags or towels to soak up spills and wipe down tools, and an anti-rust protector. *WOOD* magazine tests (issue #154) show that Boeshield T-9 (see Sources on *page 56*) is the most effective rust fighter. Bevel gauges, water pans, and honing guides are some of the accessories available to make sharpening easier and more accurate (see Sources).

Prepare the stones

To start the process, soak the stones in water for 2–5 minutes or until they stop releasing bubbles into the water. After soaking, flatten all four stones before using them to ensure a perfectly level honing surface. Peters uses an absolutely flat $500 Shapton diamond hone for this. A far less expensive, yet effective, alternative is a sheet of 150-grit silicon carbide, wet/dry abrasive paper atop a piece of ⅜"-thick glass that's about 12" square.

Thoroughly moisten your wet/dry abrasive paper and lay it flat on the glass. The water creates a suction between the paper

FLATTEN THE STONES

Scratch marks on a waterstone, like those in the one to the left, mean it's time to re-flatten the surface on a sheet of moistened abrasive.

and glass to hold the abrasive in place. To avoid contaminating fine stones with coarse particles, flatten your 8,000-grit stone first and work your way down to the 700-grit stone. Rub the stone back and forth and then in a circular motion on the paper, as shown in **Photo A**, until you no longer see scratch marks from prior use. Water pools evenly on the surface of a flattened stone, not just in the center or at the edges.

Thoroughly rinse your sandpaper between stones and rinse each stone under running water before you begin sharpening.

How to care for waterstones

Waterstones are an investment that can last for years with minimal care.

- Some people store their waterstones in water, but it's not a practice Peters recommends because it can degrade some types of stones and causes bits of trapped metal to rust, discoloring the stone.
- Never contaminate waterstones with oil or silicone lubricants that would harm the stones' ability to work.
- Prevent damp stones from freezing, which could cause them to crack.
- Store stones where they won't become nicked or cracked. A sealable plastic container provides a place to both store and soak stones.
- Peters removes the wooden bases on his stones by carefully bandsawing the stone free. This isn't a necessity, but it makes the stones easier to soak and store together. If you want to remove the bases on your stones, don't try to pry the stone loose from the wood. The stone will shatter before the glue releases.

Let's sharpen some tools

We'll show how to hone chisels here, but the concept is the same for plane blades and other cutting tools. Your goal: Create a perfectly flat bevel and back that connect at a straight, sharp edge. Until you gain experience, focus on consistency and control. Speed will come later.

Lay your flattened and soaked stones on a surface that will hold them still as you work. We used newspapers here, but a small piece of router mat works just as well and can be washed off during and after use.

Begin sharpening a chisel or plane blade by flattening the back. Working first with the 700-grit stone, hold the tool blade perpendicular to the long edge of the waterstone with about ½" of the back flat against the stone, as shown in **Photo B**. Don't flatten the entire back of the tool all at once; just remove the grind marks near the bevel.

Move the tool back and forth across the entire length of the stone while applying light to moderate pressure. Develop a consistent hand position and motion to repeat here and with the remaining three stones. You'll do both the back and the bevel before moving on to the next stone and finishing with the 8,000-grit polishing stone.

Now, let's hone the bevel. With one hand, hold the tool at a constant angle. Use the fingertips of your other hand to firmly and evenly press the bevel against the stone, as shown in **Photo C**.

Use the whole surface of the stone to avoid hollowing out the middle or one edge. Your technique will improve with practice, so don't do your best chisels first. Wait to sharpen plane blades and narrow chisels until after you've gained experience. That extra blade width helps you maintain a consistent angle because it's easier for your fingertips to feel when the bevel is firmly pressed against the stone.

If you still need help getting a consistent angle on the bevel of narrow chisels or plane blades, consider using a guide, such as the one shown in **Photo D**. There are several types available; choose one with a wide support wheel that won't dig into the surface of the stone.

At first, check your progress after every three or four strokes to correct any errors as you work. Use the troubleshooting chart on *page 56* to help you

FLATTEN THE CHISEL BACK

Begin by flattening the back of the chisel. One hand applies pressure to the blade while the other holds the tool perpendicular to the stone.

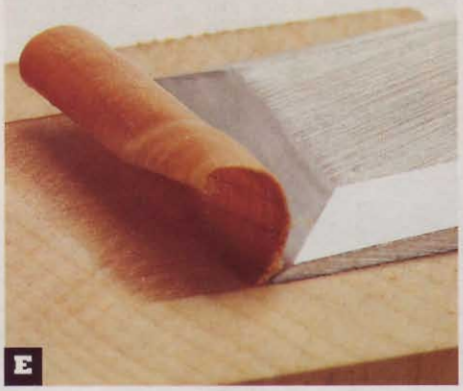
SHARPEN THE BEVEL

For all but the narrowest chisels, use two fingers to distribute pressure on the bevel while honing. Hold the other hand at a constant level.

USE GUIDES FOR NARROW CHISELS

Use a honing guide until you develop a feel for pressing a chisel or plane blade bevel flat against the sharpening stone.

THE PAYOFF: A RAZOR EDGE



E

A flat bevel and flat chisel back produce an edge sharp enough to make the thinnest of shavings, even in end grain.

spot flaws in your technique and undo them before they become problem habits.

After you've achieved a consistent surface on both the back and bevel, it's time to move on to the next stone until you reach the 8,000-grit polishing stone. You're ready to change stones when all the scratches made by the previous stone have been removed. First, however, rinse and wipe the tool to remove all honing residue that could contaminate the finer stones.

"Give me six hours to chop down a tree and I will spend the first four sharpening the axe."

—Abraham Lincoln

As you hone on the two coarser stones, you'll feel, or perhaps see, a fine wire edge form. This will disappear before you're finished. As you progress from one stone to the next, your goal is to polish over the scratches left by the previous stone.

By the time you complete the 8,000-grit stage, the cutting edge should have a mirror finish. Rinse and dry the tool, then give it a coat of waterproofing (being careful not to let it come in contact with the waterstones). Test your sharpening skills by skimming a curl of wood from the end of a piece of scrap, as shown in **Photo E**. The stones should be allowed to dry before storage.

Preserve this razor-sharp edge by using inexpensive chisel guards (see Sources) that cover the tip.

Sources

Waterstones. Hida Tool Co. is offering the Bester 700 and 1200, Shapton 2000, and Takenoko 8000 waterstones used by Tim Peters for $165 plus $10.50 shipping and handling (California residents add 8.75 percent sales tax), nearly $20 off the regular price if sold separately. When ordering, mention the "*WOOD* magazine special." To reach Hida Tool, call 800/443-5512 or visit hidatool.com. Mail orders may be sent to Hida Tool & Hardware Co., 1333 San Pablo Ave., Berkeley, CA 94702. This special offer expires December 31, 2004.

Honing guide. Veritas Sharpening System with honing guide and angle jig (05M02.10, $34.95). Contact Lee Valley Tools, 800/871-8158; leevalley.com.

Sharpening accessories. Accessories for easier, more accurate results include a bevel gauge (50K09.01, $3.95) and Stone Pond sharpening stone soaker and holder (05M20.06, $44.50). Contact Lee Valley Tools.

Chisel guards. Set of 10 chisel guards (33E01.01, $4.50) is from Lee Valley Tools.

Anti-rust protectant. Boeshield T-9. Contact PMS Products, Inc., 800/962-1732; boeshield.com.

How to Troubleshoot Bevel Sharpening Mistakes

Problem: Honing marks show more on one side of the bevel than the other.

Solution: Narrow chisels (¼–½") present a small contact area between the bevel and the stone, making it hard to keep the blade flat as you hone. Use a honing guide or practice first on wide chisels to develop a routine before moving on to narrow ones.

Problem: Honing marks appear wider at the bottom than the top or are only on one end of the bevel.

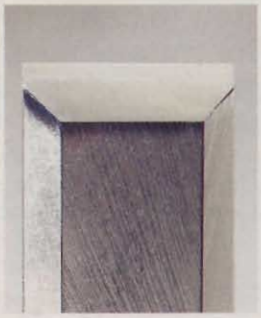
Solution: Check your progress frequently as you hone and concentrate on keeping your handle angle consistent, even if that means lightening up on your honing pressure.

Problem: Honing marks don't reach the center of the bevel.

Solution: Wheel grinders leave a shallow concave, called a hollow ground, so grinding marks in the center are the last ones removed by a flat stone. Continue honing until you have a uniform surface, which signals a flat bevel.

Problem: Multiple facets show on the bevel.

Solution: If your chisel looks like this after grinding, go back and even out the bevels until you have a uniform surface. If this is a result of honing, focus on making stable, consistent arm and hand movements as the bevel travels back and forth across the stone.



Problem: Not knowing when to stop.

Solution: This bevel is nearly finished. (Note the remaining scratches on the upper left.) A few more passes on the 8,000-grit stone will leave a polished surface and a sharp edge. The ideal bevel will reflect a flash of light off the surface the way sunlight flashes off a mirror.

TOP-DRAWER

ARTS & CRAFTS DRESSER

As part of a bedroom suite, or just by itself, the design of this handsome piece of furniture appears as fresh and vigorous today as it did a century ago.

The series continues...

Interested in building matching pieces or a complete bedroom ensemble? You'll find plans for the bed in the October 2004 issue, the nightstand in the November 2004 issue, the mirror on *page 22*, and the blanket chest in the February 2005 issue. Visit woodmagazine.com/mission for dozens of downloadable mission furniture woodworking plans.

AT A GLANCE

- Overall dimensions are 44" wide × 21" deep × 53" high.
- For the board feet of lumber and other items needed to build this project, see *page 69*.

This tall Arts & Crafts dresser, styled with corbels and arched lower rails, offers ample drawer and cabinet storage. As an option, you can outfit the dresser with the mirror shown in the inset photo, *below left*. See *page 22*.

First, build the case

1 From ¾" birch plywood, cut the sides (A), divider (B), case top (C), cabinet shelf (D), large drawer shelf and bottom (E), small drawer shelves (F), and adjustable shelves (G) to the sizes listed i n the **Materials List**. Then from quartersawn white oak, cut the side bands (H), divider band (I), and adjustable shelf bands (J) to size. Glue and clamp the bands to the mating parts, where shown on **Drawing 1**. When the glue dries, sand the bands flush.

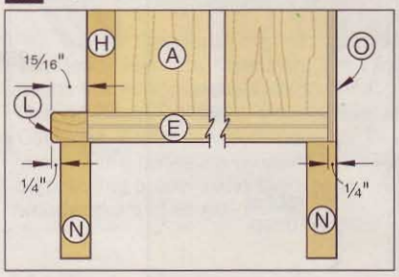
2 Cut ¾" rabbets ⅜" deep and ¾" dadoes ⅜" deep in the sides (A/H), and ¾" dadoes ⅜" deep in one face of the divider (B/I), case top (C), and cabinet shelf (D), where dimensioned on **Drawings 1** and **2**. Then lay out hole centers and drill ¼" shelf-pin holes in the left side and divider with a brad-point bit.

Note: *Because the divider (B) fits into a ⅜"-deep dado in the case top (C), there is a ⅜" difference in the distance from the top of the divider and sides (A) to the upper dadoes. To avoid misalignment, carefully follow the dimensions on* **Drawing 2**. *The same ⅜" difference also applies to the layout of the shelf-pin holes.*

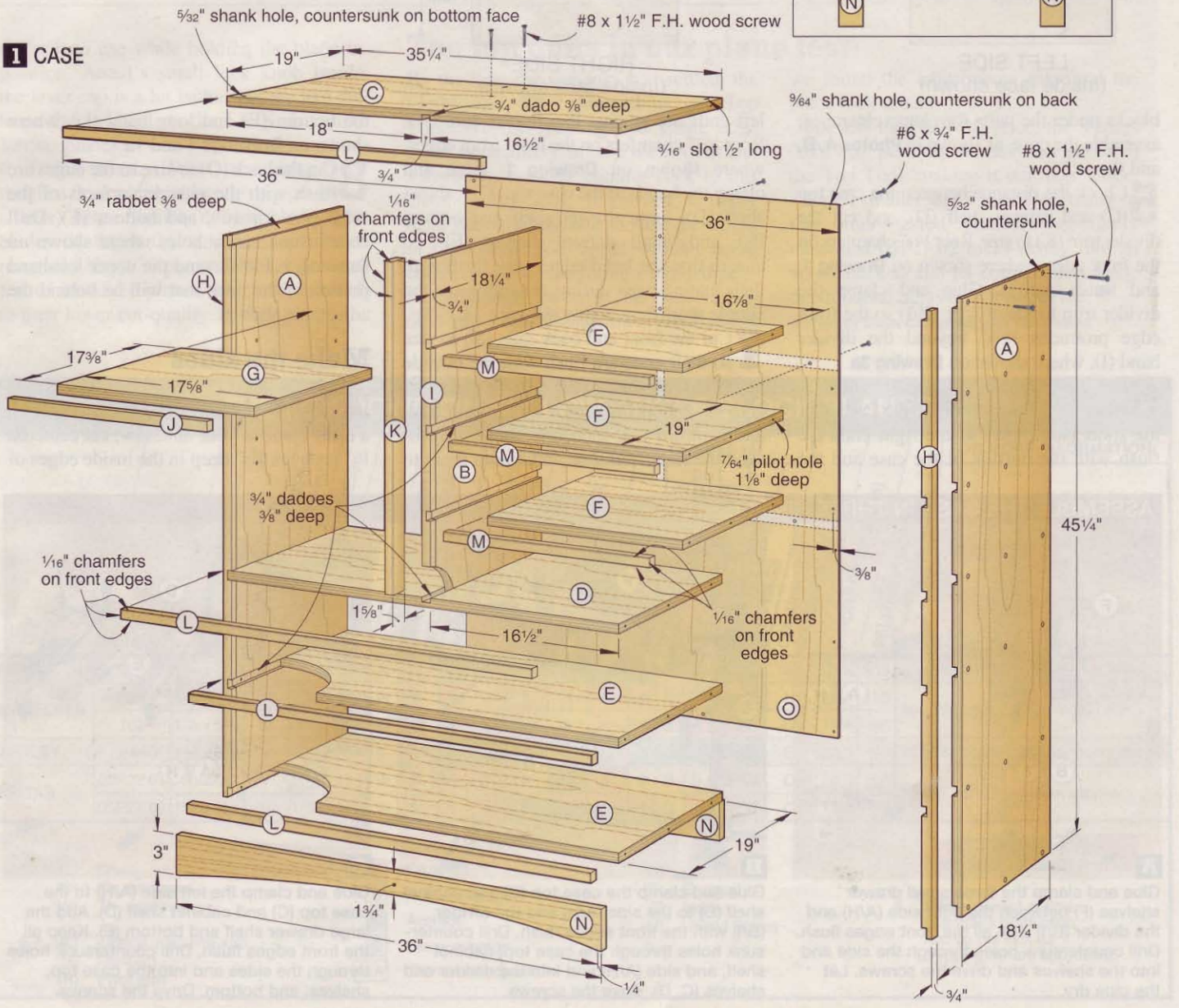
3 For fastening the top (W) to the case later, drill 5/32" countersunk shank holes and form 3/16" slots ½" long in the case top (C), where shown on **Drawings 1** and **3**.

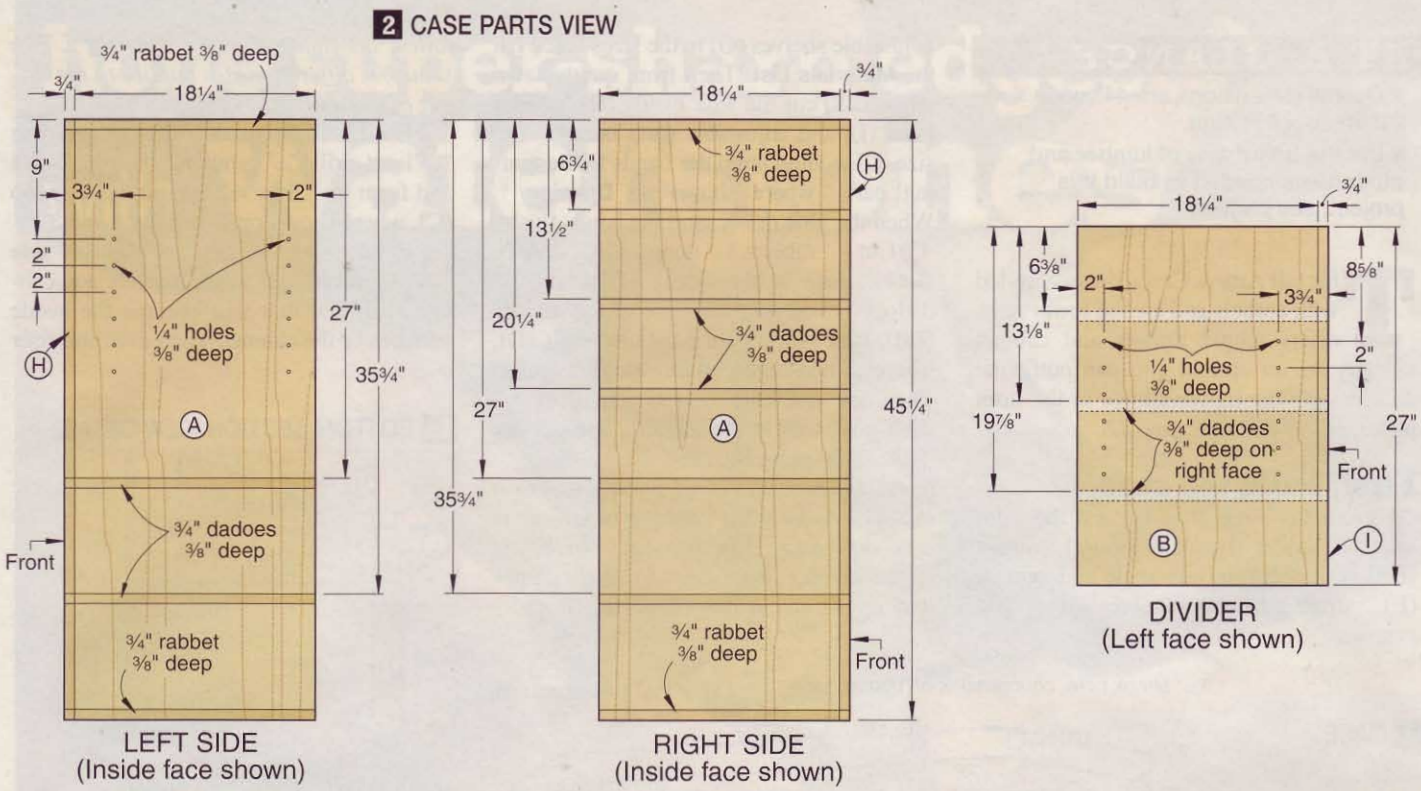
4 Finish-sand the areas of the left side (A), divider (B), case top (C), and cabinet shelf (D) that will become the inside surfaces of the cabinet. Then inserting riser

1a BOTTOM SECTION VIEW DETAIL



1 CASE





blocks under the parts for clamp clearance, assemble the case, as shown in **Photos A**, **B**, and **C**.

5 Check the distance between the case top (C) and cabinet shelf (D), and cut the divider trim (K) to size. Rout 1/16" chamfers on the front edges, where shown on **Drawing 1**, and finish-sand it. Glue and clamp the divider trim to the divider (B/I) so the front edge protrudes 15/16" beyond the divider band (I), where shown on **Drawing 3a**.

6 Cut the long bands (L) so the ends are flush with the outside of the case. Cut the short bands (M) so the right ends are flush with the outside of the case and the left ends are against the divider trim (K). Rout 1/16" chamfers on the band front edges, where shown on **Drawing 1**. Glue and clamp the bands to the case top (C), cabinet shelf (D), large drawer shelf and bottom (E), and small drawer shelves (F). To ensure that the band edges stay flush with their mating parts during assembly, see the simple workshop helper on *page 34*.

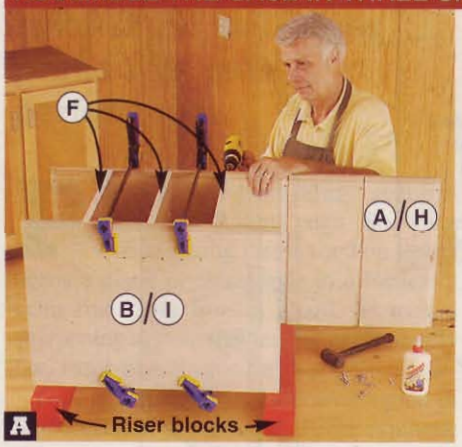
7 Cut the front and back rails (N) to size so their ends are flush with the outside of the case. Using a fairing stick, draw the arch shown on **Drawing 1** on the front rail, and bandsaw and sand it to shape. Finish-sand the rails, and glue and clamp them to the bottom (E) and long band (L), where shown on **Drawings 1** and **1a**.

8 Cut the back (O) to size so the edges are flush with the outside surfaces of the sides (A), top (C), and bottom (E). Drill countersunk screw holes where shown on **Drawing 1**. Finish-sand the upper left-hand portion of the back that will be behind the adjustable shelves.

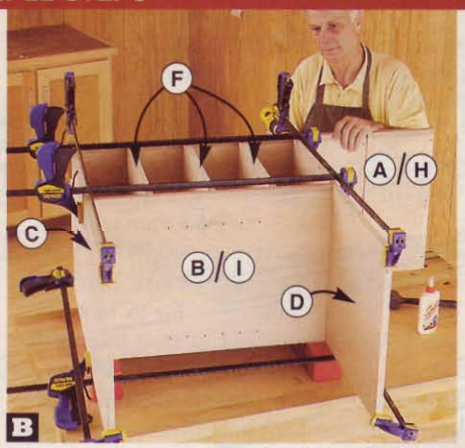
Make the sides

1 Cut the stiles (P), upper rails (Q), lower rails (R), and muntins (S) to size. With a dado blade in your tablesaw, cut centered ¼" grooves 5/16" deep in the inside edges of

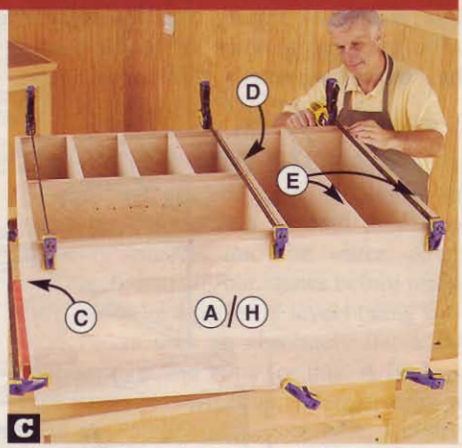
ASSEMBLE THE CASE IN THREE SIMPLE STEPS



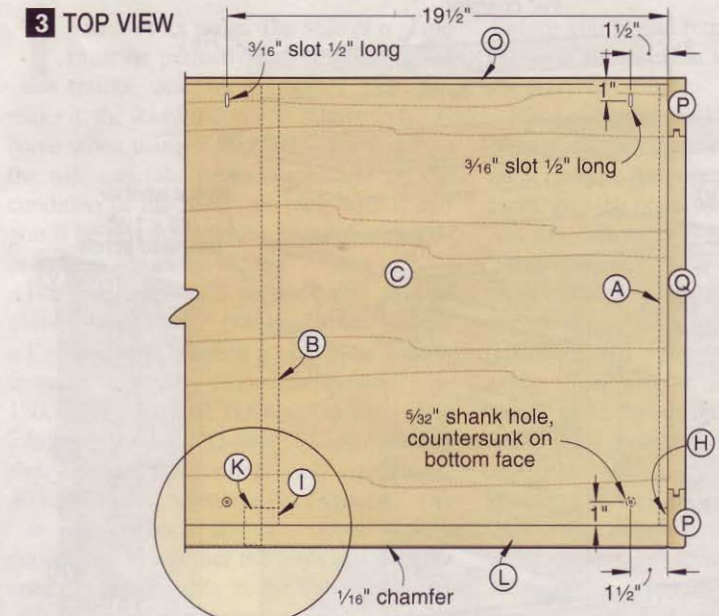
Glue and clamp the three small drawer shelves (F) between the right side (A/H) and the divider (B/I) with all the front edges flush. Drill countersunk holes through the side and into the shelves and drive the screws. Let the glue dry.

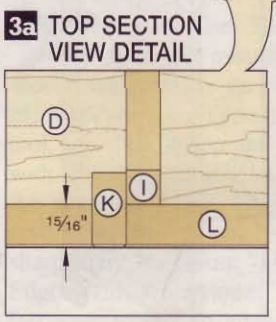


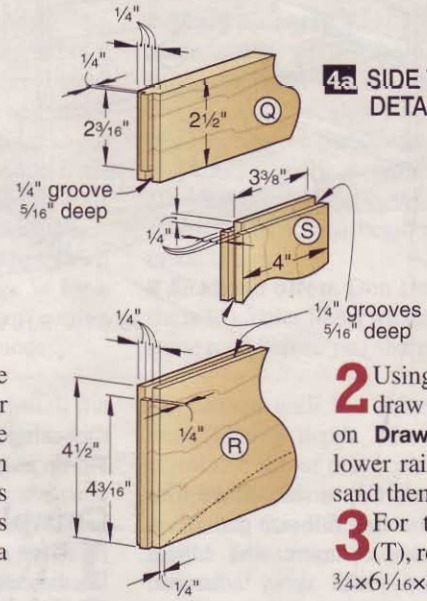
Glue and clamp the case top (C) and cabinet shelf (D) to the side (A/H) and the divider (B/I) with the front edges flush. Drill countersunk holes through the case top, cabinet shelf, and side (A/H) and into the divider and shelves (C, D). Drive the screws.

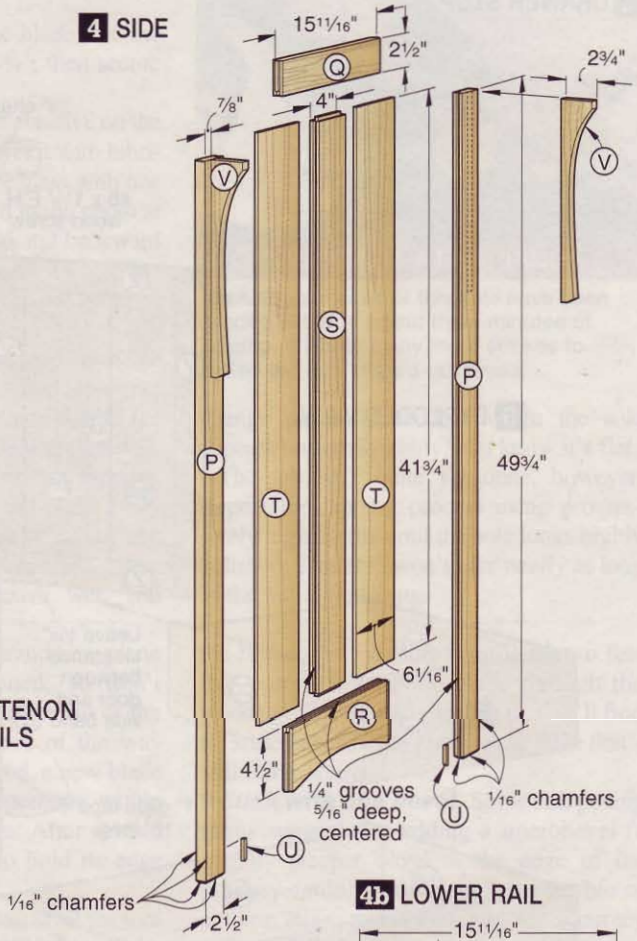


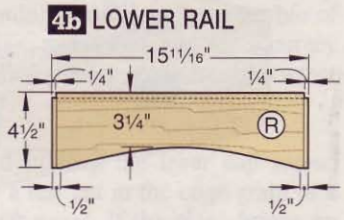
Glue and clamp the left side (A/H) to the case top (C) and cabinet shelf (D). Add the large drawer shelf and bottom (E). Keep all the front edges flush. Drill countersunk holes through the sides and into the case top, shelves, and bottom. Drive the screws.











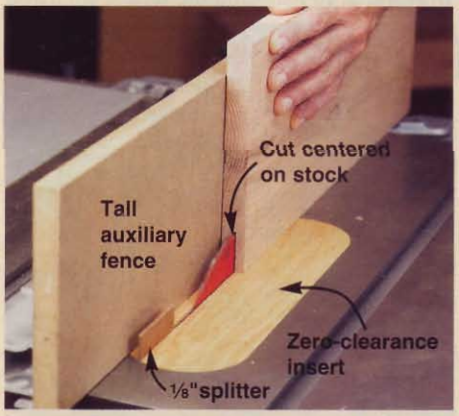
the stiles, bottom edges of the upper rails, top edges of the lower rails, and both edges of the muntins, where shown on **Drawing 4**. Now form the tenons shown on **Drawing 4a** on the rails and muntins, checking them for a snug fit in the grooves.

2 Using a fairing stick, draw the arch shown on **Drawing 4b** on the lower rails, and saw and sand them to shape.

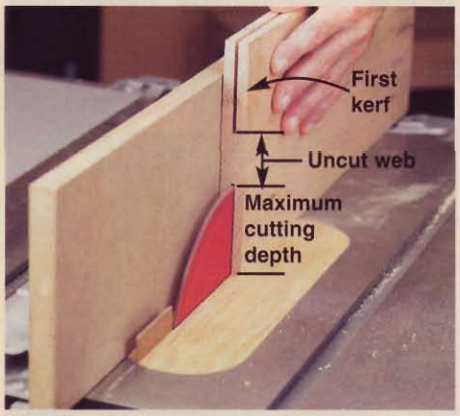
3 For the side panels (T), resaw in half two ¾x6 1/16x41¾" boards. To resaw wide boards without a bandsaw, see the sidebar, *below*. Plane the resulting pieces to ¼" thick, testing the fit in the side frame grooves. The panels will be book-

LOW-TECH RESAWING FOR WIDE BOARDS

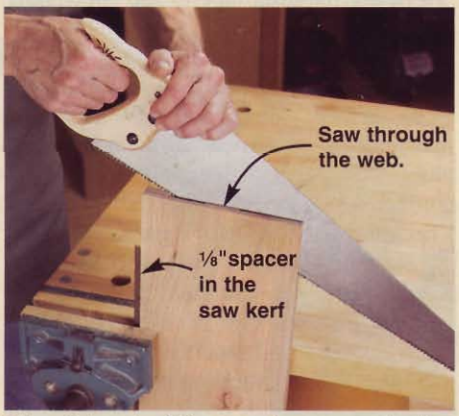
A 6"-wide board is about the limit for resawing on a 14" bandsaw without a riser block. So how do you resaw something wider if all you have is a standard bandsaw, or no bandsaw at all? Here's how to do it with your tablesaw and a little elbow grease.



Step 1 Outfit your tablesaw with a tall auxiliary fence and a zero-clearance insert with a 1/8" splitter. Position the fence to center the board on the blade.

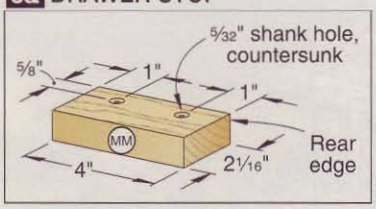


Step 2 Working alternately from both edges, make a series of shallow cuts, progressively raising the blade until reaching the maximum cutting depth of the saw.

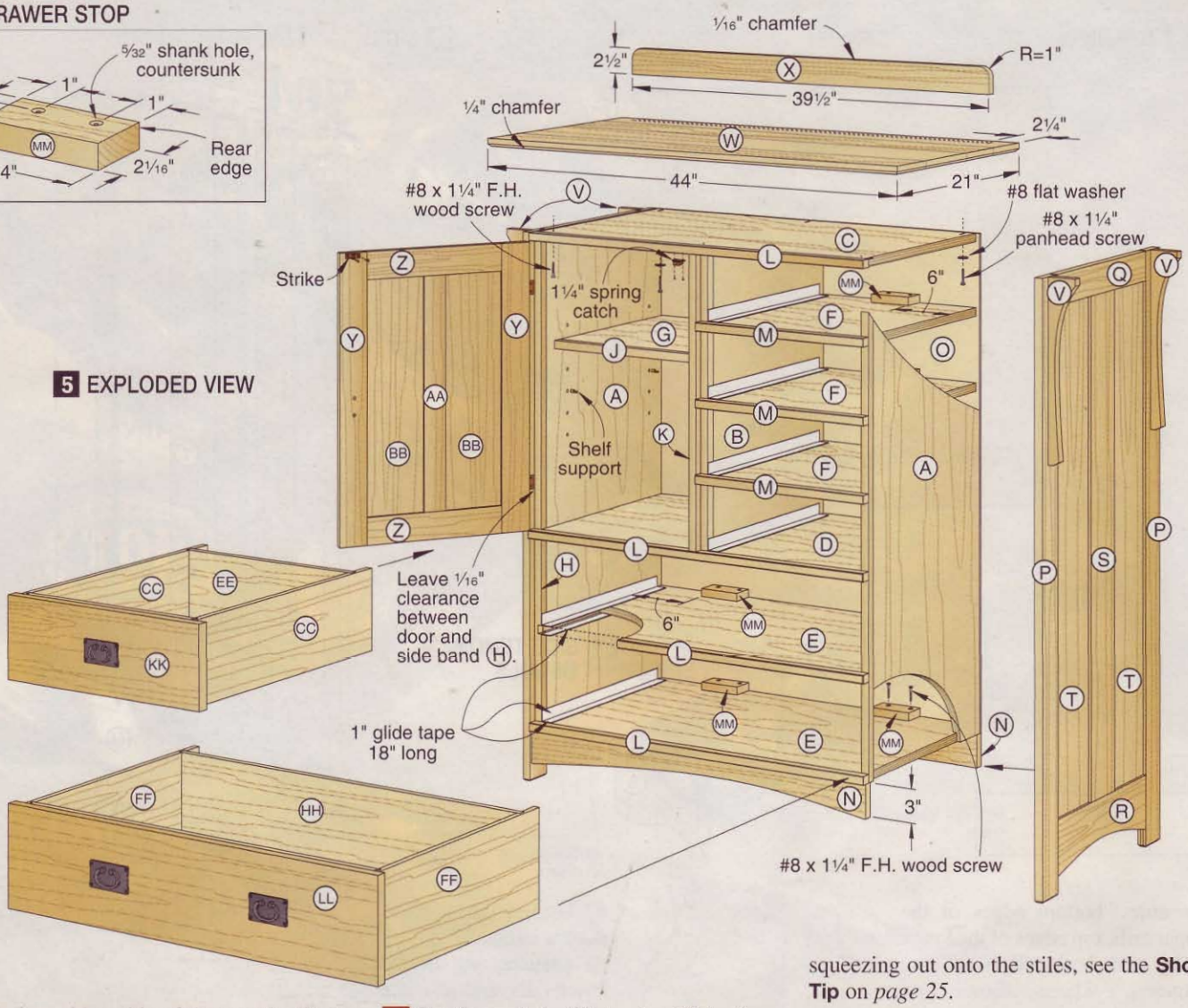


Step 3 Insert a 1/8" spacer in one saw kerf, and clamp the board in your bench vise. Use a handsaw to cut through the web between the kerfs cut with the tablesaw.

5a DRAWER STOP



5 EXPLODED VIEW



matched on either side of the muntin (S) at assembly, so mark the mating edges. Finish-sand and stain the panels. (We applied one coat of Watco Dark Walnut Danish Oil, following the instructions on the can.)

***Note:** Staining the panels before assembly eliminates the possibility of seasonal wood movement exposing an unstained portion.*

4 Apply masking tape to the upper rails (Q), lower rails (R), and muntins (S), and mark the part centerlines. Then glue and clamp the parts, as shown in **Photo D**. Slide in the side panels (T) in book-matched orientation, leaving them loose (no glue). Now apply glue only to the rail tenons and clamp the stiles (P) in place. Check the assemblies for square.

5 Resaw and plane a 1/4×5/16×12" blank for the fillers (U). Cut the fillers to length, glue them in the stile (P) slots below the lower rails (R), and sand them flush.

6 Rout 1/16" chamfers on the front edges and bottom ends of the front stiles (P) and the rear edges and bottom ends of the rear stiles (P), where shown on **Drawing 4**. Finish-sand the side assemblies.

7 Cut the corbels (V) to size. Make four copies of the corbel full-size pattern on the *WOOD Patterns®* insert, and adhere them to the parts with spray adhesive. Bandsaw and sand the corbels to shape, remove the patterns, and finish-sand them. Glue and clamp the corbels to the side assemblies centered on the stiles (P) and flush at the top. To keep the glue from squeezing out onto the stiles, see the **Shop Tip** on *page 25*.

Complete the case

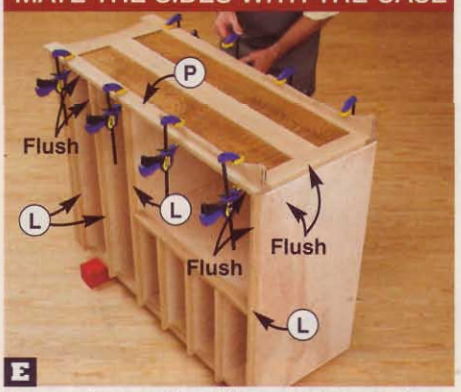
1 Glue and clamp the side assemblies to the case, as shown in **Photo E**.

2 Edge-join an oversize blank for the top (W), and trim it to finished size. Then rout 1/4" chamfers along the bottom of the ends and front edge, where shown on **Drawing 5**. Finish-sand the top.

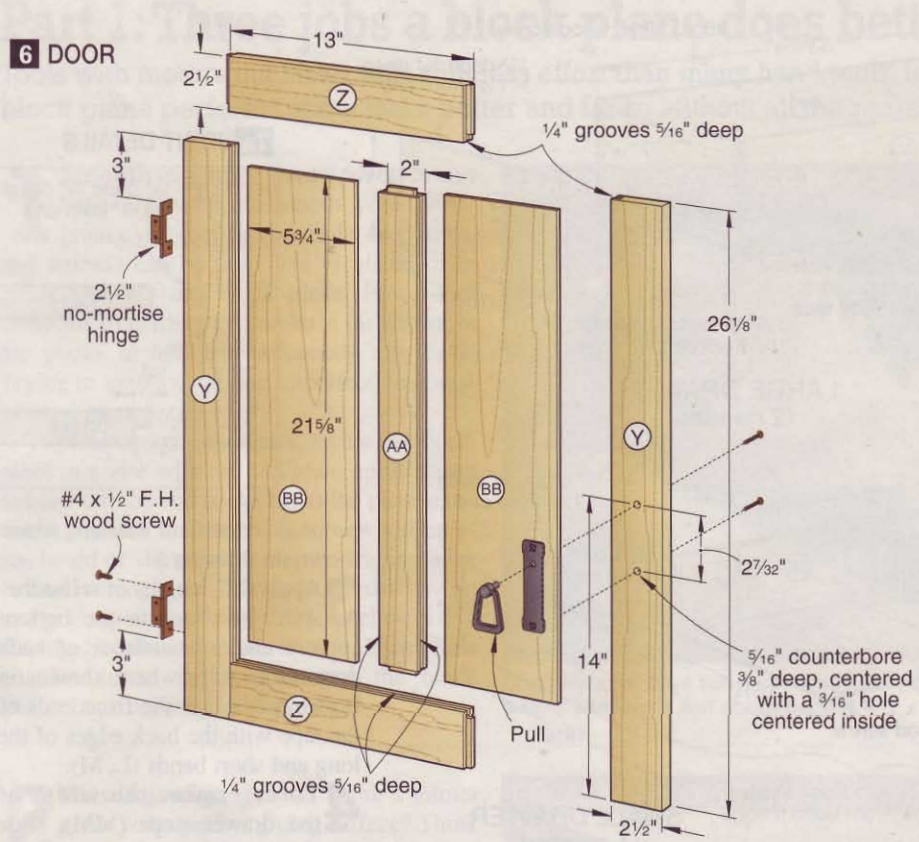
CENTERLINES AID ALIGNMENT

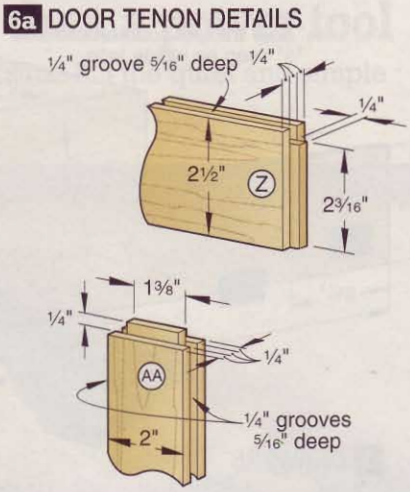
Align the centerlines marked on masking tape on the rails (Q, R) and muntin (S), and then glue and clamp the parts together.

MATE THE SIDES WITH THE CASE



Glue and clamp the side assemblies to the case with the tops flush and the front stiles (P) flush with the long bands (L).





3 Cut the crest rail (X) to size. Draw 1" radii on the corners, where shown on **Drawing 5**, and saw and sand them to shape. Rout a 1/16" chamfer along the front edge, where shown, and finish-sand the part. Glue and clamp the crest rail to the top (W), flush at the back and centered side-to-side.

Note: If you are building the matching mirror on page 22 *to mount on the dresser, omit the crest rail (X).*

Next build a door

1 Cut the stiles (Y), rails (Z), and muntin (AA) to size. With a dado blade in your tablesaw, cut centered ¼" grooves 5/16" deep in the inside edges of the stiles, bottom edge of the upper rail, top edge of the lower rail, and both edges of the muntin, where shown on **Drawing 6**. Now form the tenons, shown on **Drawing 6a**, on the rails and muntins, checking them for a snug fit in the stile and rail grooves.

Note: For the door to fit with a 1/16" space all around, the opening should be 17⅝x26¼". If your opening is different, make the appropriate adjustments to the door part dimensions.

2 For the panels (BB), resaw in half a ¾x5¾x21⅝" board. Plane the resulting pieces to ¼" thick, testing the fit in the door frame grooves. As with the side assemblies, the door panels will be book-matched, so mark the mating edges. Finish-sand and stain the panels.

3 Mark the centerlines of the rails (Z) and muntins (AA) on masking tape as you did when gluing up the side assemblies. Then glue and clamp the rails and muntins and slide in the door panels (BB) in book-matched orientation, leaving them loose. Now apply glue only to the rail tenons, and clamp the stiles (Y) in place. Check the door to make sure it is square and flat, and finish-sand it.

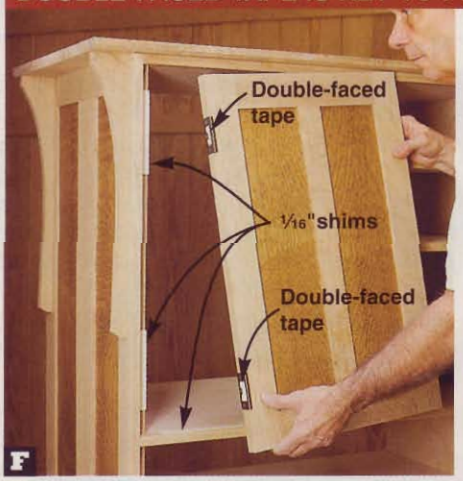
4 Mount the hinges on the door, where shown on **Drawing 6**. Then, making sure the case is sitting flat so the door opening is square, temporarily install the door, as shown in **Photos F** and **G**. Open the door and drill hinge screw pilot holes. Remove the door and peel the tape off the hinges.

5 Drill counterbored holes for the pull, where dimensioned on **Drawing 6**. Finish-sand the door.

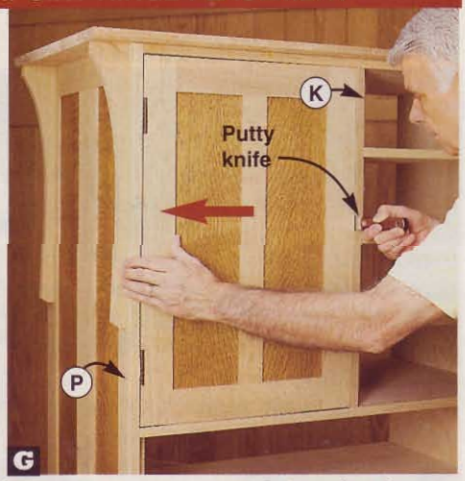
Make drawers in two sizes

1 From ½" stock, cut the small sides (CC), small fronts (DD), small backs (EE), large sides (FF), large fronts (GG), and large backs (HH) to size. Following the two steps on **Drawing 7b**, cut lock rabbets, shown on **Drawing 7a**, at the front corners of the drawer fronts and sides. Then cut ½" dadoes in the sides, where dimensioned on **Drawing 7a**. Check the thickness of your ¼" plywood, and cut grooves for the bottoms in the sides and fronts, where shown on **Drawing 7**. Drill screw shank holes, countersunk on the inside face, through the drawer fronts at the corners, where shown.

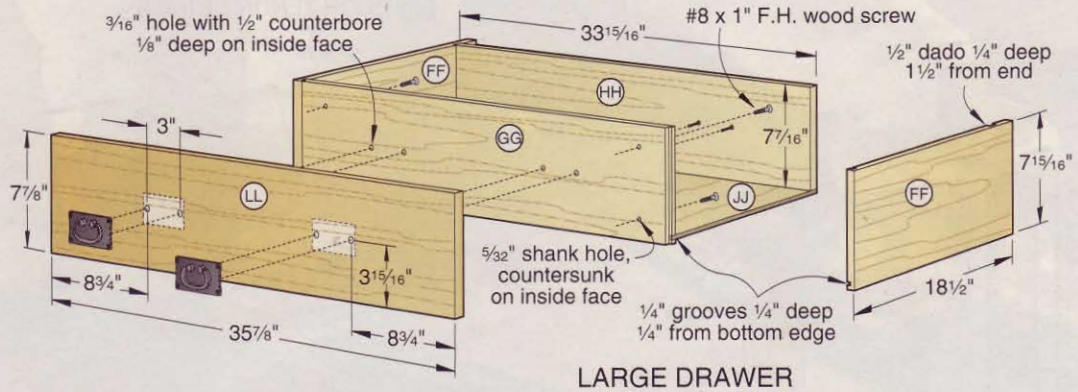
DOUBLE-FACED TAPE IS KEY TO PINPOINT HINGE PLACEMENT



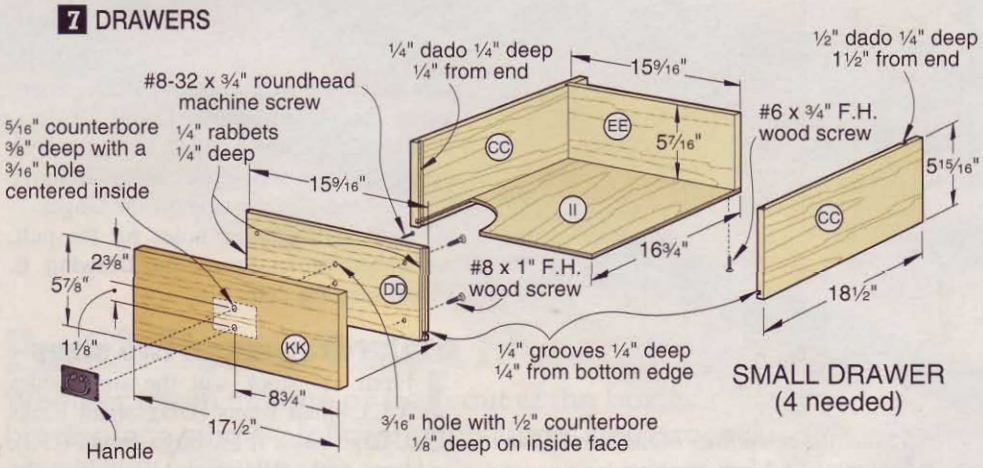
To keep the door from binding on the left side band (H), tape 1/16" shims to the front edge of the band. Tape another 1/16" shim at the bottom of the door opening. Then apply double-faced tape to the hinge leaves.



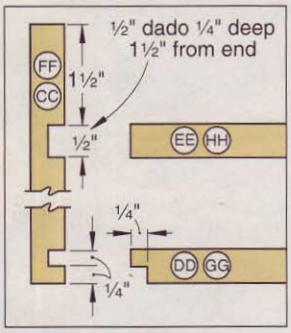
Position the door, pressing it against the side band shims and resting it on the bottom shim. Insert a putty knife between the door and the divider trim (K), and push the hinge leaves against the front stile (P).



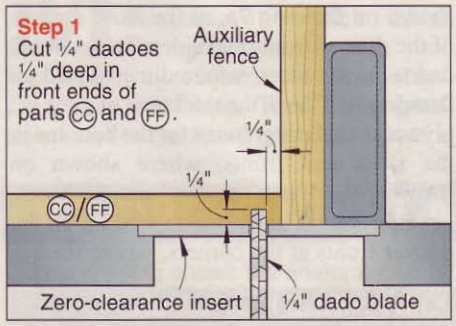
7 DRAWERS

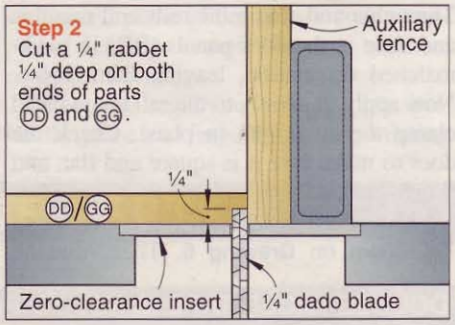


7a JOINT DETAILS



7b LOCK RABBET JOINT





Now glue and clamp the drawers together, making sure they dry flat and square. Finish-sand the drawers.

2 Cut the small bottoms (II) and large bottoms (JJ) to size, and finish-sand them. Squeeze glue into the grooves in the drawer fronts (DD, GG) and slide the bottoms in place. Check the drawers for square once more and clamp the bottoms to the backs (EE, HH). Drill countersunk screw holes through the bottoms and into the backs, and drive the screws.

3 Cut the small faces (KK) and large faces (LL) to size. Drill counterbored holes for the handles, where dimensioned on **Drawing 7**. Finish-sand the faces.

Note: For a 1/16" space all around the drawer faces (KK, LL), they should be 1/8" smaller in width and length than the drawer openings.

Now finish and assemble

1 Remove all hardware and resand any areas that need it. Stain the case, adjustable shelves, top, door, and drawer faces. When staining the case, stain the inside of the cabinet and about 2" back from the front edges of the banding in the drawer areas. We did not stain the case back (O) or the drawer boxes. With the stain dry, apply a clear finish. (We brushed on two coats of oil-based satin polyurethane, lightly sanding with 220-grit sandpaper between coats.)

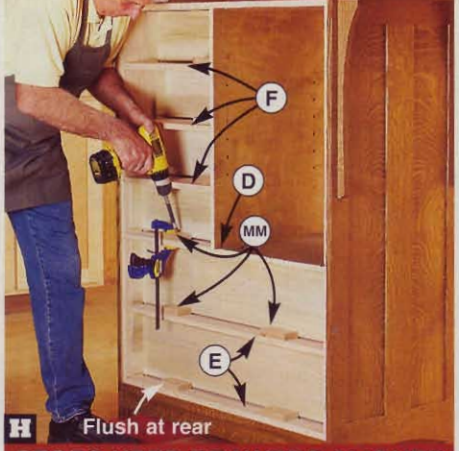
2 Clamp the top/crest rail assembly (W/X) to the case, flush at the back and centered side-to-side. Using the countersunk holes and the centers of the slots in the case top (C) as guides, drill pilot holes into the top (W), and fasten with flathead wood screws and panhead screws and washers, where shown on **Drawing 5**.

3 Apply 18" lengths of self-adhesive glide tape to the bottom corners and top surfaces of each drawer opening, where shown on **Drawing 5**. Align the front ends of the tape with the back edges of the long and short bands (L, M).

4 To determine the width of the drawer stops (MM), slide the drawers in place so the fronts (DD, GG) protrude 1/16" beyond the side bands (H) and divider band (I). Measure the distance from the rear edges of the cabinet and drawer shelves (D, E, F) to the drawer backs, and cut the stops to size. Drill countersunk shank holes in the stops, where shown on **Drawing 5a**. Now clamp the stops to the shelves, where shown on **Drawing 5**, and fasten them in place, as shown in **Photo H**.

5 Apply double-faced tape to the backs of the drawer faces (KK, LL). Then using 1/16" shims at the bottom and sides, temporarily screw the faces in place, as shown in **Photo I**. With the drawer faces in place, remove the drawers, marking the location of each one on the back. Using the four countersunk holes in each drawer front (DD, GG) as guides, drill pilot holes into the drawer faces and drive the screws. Remove the wood screws from the handle holes and drill 1/2" counterbores in the drawer front inside faces. Using the handle holes in the drawer faces as guides, drill 3/16" holes through the drawer fronts. Install the handles, and slide the drawers into the case.

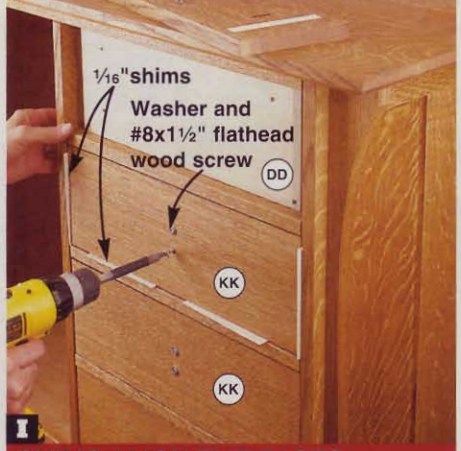
Note: The drawer fronts are dimensioned 1/16" wider than the widths of the drawer faces (KK, LL). This keeps the drawer boxes from fitting too loosely while maintaining a 1/16" space all around between the drawer faces and the case. The extra width of the drawer fronts protrudes beyond the faces at the bottom and is not visible.



H

STOPS KEEP DRAWERS ALIGNED

Clamp the drawer stops (MM) to the shelves (D, E, F) and bottom (E) flush at the rear. Using the holes in the stops as guides, drill pilot holes and screw the stops in place.



I

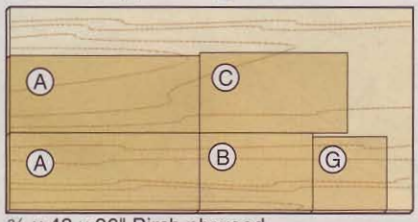
SHIMS ALIGN THE FACES

With the drawer face (KK) shimmed at the bottom and sides, use the handle holes as guides and drill 7/64" pilot holes through the drawer front (DD). Screw the face to the front.

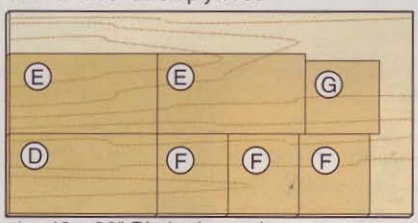
6 Install the door pull and the hinges, and hang the door. Install the spring catch, where shown on **Drawing 5**.

7 Position the back (O) on the case, drill pilot holes, and screw it in place. Install shelf supports and the adjustable shelves. Place the dresser in your bedroom and start thinking how good it would look with a matching bed, nightstands, and chest.

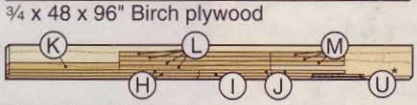
Cutting Diagram



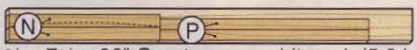
¾ x 48 x 96" Birch plywood



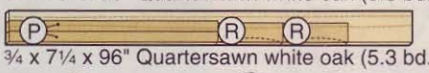
¾ x 48 x 96" Birch plywood



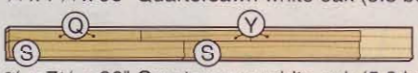
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)



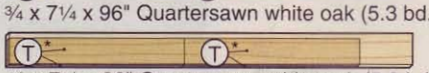
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)



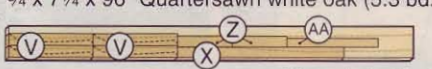
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)



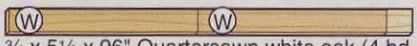
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)



¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)

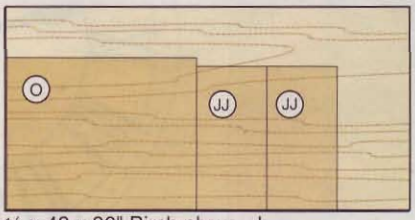


¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)

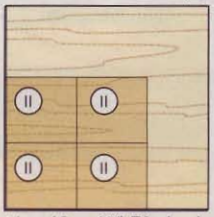


¾ x 5½ x 96" Quartersawn white oak (4 bd. ft.) (2 needed)

¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)

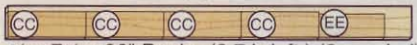


¼ x 48 x 96" Birch plywood

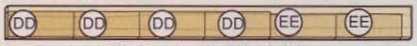


*Resaw and plane to the thicknesses listed in the Materials List.

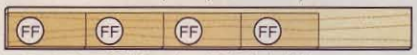
¼ x 48 x 48" Birch plywood



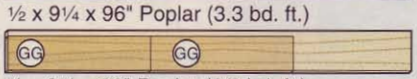
½ x 7¼ x 96" Poplar (2.7 bd. ft.) (2 needed)



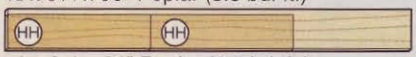
½ x 7¼ x 96" Poplar (2.7 bd. ft.)



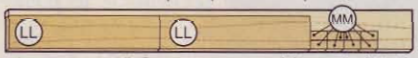
½ x 9¼ x 96" Poplar (3.3 bd. ft.)



½ x 9¼ x 96" Poplar (3.3 bd. ft.)



½ x 9¼ x 96" Poplar (3.3 bd. ft.)



¾ x 9¼ x 96" Quartersawn white oak (6.7 bd. ft.)

Source

Hardware. 2½x¾" bronze no-mortise hinges no. 00H51.23 (1 pair), #4x½" antique brass flathead wood screws no. 01Z10.41 (pack of 100), 2¾" black mission handle no. 01W32.11 (4), 3¾" black mission handle no. 01W32.10 (4), 1" black mission pull no. 01W32.12 (1), antique bronze spring catch no. 00W11.01 (1), 1"x18' roll glide tape no. 25U04.01 (3 rolls), brass shelf support no. 63Z06.04 (package of 20). Discount kit no. 05D15.17, $56. Items may be ordered individually at regular prices. Call Lee Valley 800/871-8158, or go to leevalley.com.

Written by **Jan Svec** with **Chuck Hedlund**
Project design: **Kevin Boyle** Illustrations: **Roxanne LeMoine**

Materials List

Case	FINISHED SIZE T	W	L	Matl.	Qty.
A sides	¾"	18¼"	45¼"	BP	2
B divider	¾"	18¼"	27"	BP	1
C case top	¾"	19"	35¼"	BP	1
D cabinet shelf	¾"	19"	35¼"	BP	1
E large drawer shelf and bottom	¾"	19"	35¼"	BP	2
F small drawer shelves	¾"	19"	16⅞"	BP	3
G adjustable shelves	¾"	17⅜"	17⅝"	BP	2
H side bands	¾"	¾"	45¼"	QWO	2
I divider band	¾"	¾"	27"	QWO	1
J adjustable shelf bands	¾"	¾"	17⅝"	QWO	2
K divider trim	¾"	1⅝"	26¼"	QWO	1
L long bands	¾"	15/16"	36"	QWO	4
M short bands	¾"	15/16"	17⅝"	QWO	3
N front and back rails	¾"	3"	36"	QWO	2
O back	¼"	36"	45¼"	BP	1
Sides and top					
P stiles	¾"	2½"	49¾"	QWO	4
Q upper rails	¾"	2½"	15 1/16"	QWO	2
R lower rails	¾"	4½"	15 1/16"	QWO	2
S muntins	¾"	4"	41¾"	QWO	2
T* panels	¼"	6 1/16"	41¾"	QWO	4
U* fillers	¼"	5/16"	1½"	QWO	4
V corbels	¾"	2¾"	20"	QWO	4
W* top	¾"	21"	44"	EQWO	1
X crest rail	¾"	2½"	39½"	QWO	1
Door					
Y stiles	¾"	2½"	26⅛"	QWO	2
Z rails	¾"	2½"	13"	QWO	2
AA muntin	¾"	2"	21⅝"	QWO	1
BB* panels	¼"	5¾"	21⅝"	QWO	2
Drawers					
CC small sides	½"	5 15/16"	18½"	P	8
DD small fronts	½"	5 15/16"	15 9/16"	P	4
EE small backs	½"	5 7/16"	15 9/16"	P	4
FF large sides	½"	7 15/16"	18½"	P	4
GG large fronts	½"	7 15/16"	33 15/16"	P	2
HH large backs	½"	7 7/16"	33 15/16"	P	2
II small bottoms	¼"	15 9/16"	16¾"	BP	4
JJ large bottoms	¼"	33 15/16"	16¾"	BP	2
KK small faces	¾"	5⅞"	17½"	QWO	4
LL large faces	¾"	7⅞"	35⅞"	QWO	2
MM drawer stops	¾"	2 1/16"	4"	QWO	8

*Parts initially cut oversize. See the instructions.

Materials key: BP–birch plywood, QWO–quartersawn white oak, EQWO–edge-joined quartersawn white oak, P–poplar.

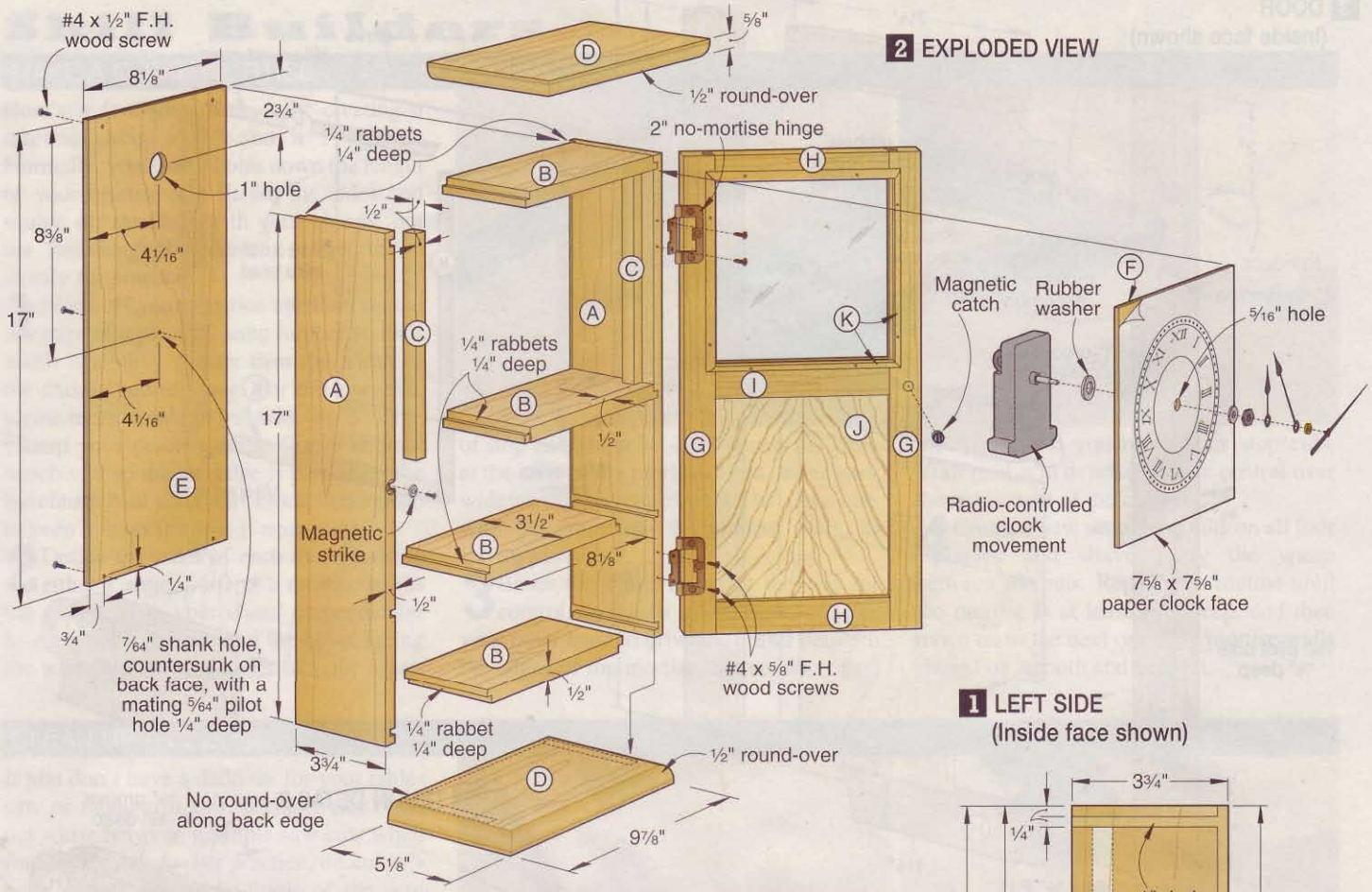
Supplies: #6x¾" flathead wood screws; #8x1", #8x1¼", and #8x1½" flathead wood screws; #8x1¼" panhead screws; #8 flat washers; masking tape; spray adhesive.

Blades and bits: Stack dado set, ¼" brad-point bit, chamfer router bit.

split-second perfect shaker clock

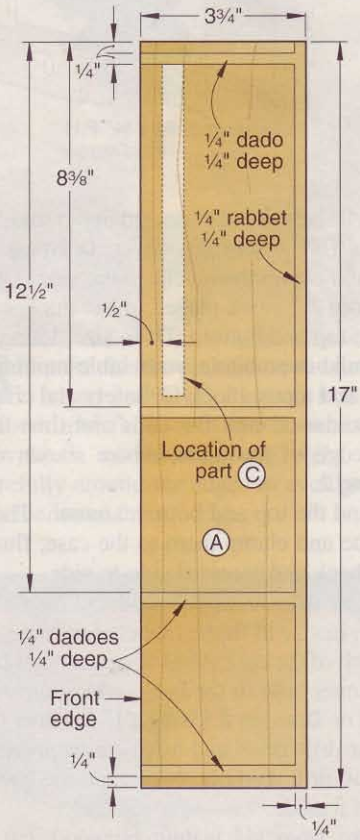
Classic 19th-century styling combined with an inexpensive piece of 21st-century technology—a radio-controlled clock synchronized to an atomic clock—gives this masterpiece timeless good looks and impeccable precision.

Open the magnetically latched door and voilà—you have access to two shelves for hidden storage of small items.



2 EXPLODED VIEW

1 LEFT SIDE
(Inside face shown)



For the board feet of lumber and other items needed to build this project, see *page 74*.

Using straightforward dado and rabbet joinery for the clock case and frame-and-panel construction for the door, you easily can build this beautiful timepiece in a weekend or a few evenings. Whether you make it from walnut with a book-matched spalted-maple panel *(left)* or cherry (inset photo), you'll find the clock kit, listed in **Sources**, a true convenience. The kit includes a clock movement and face, all of the needed hardware, and a matching wood knob. Also available here, a blank for making the spalted-maple panel.

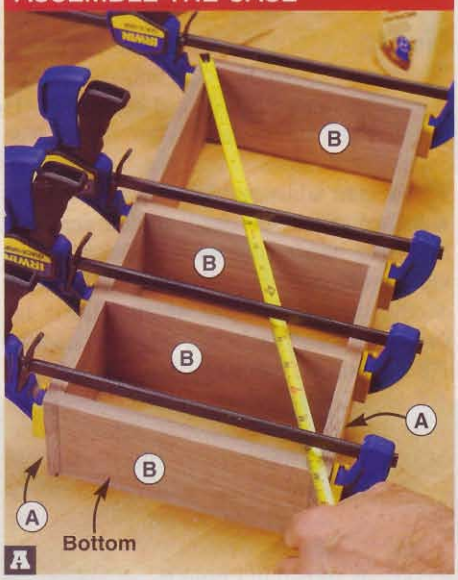
Let's start with the case

1 From ¾" stock planed to ½" thick, cut the sides (A) and four shelves (B) to the sizes listed in the **Materials List**.

2 On the inside face of the sides (A), lay out the locations for four ¼" dadoes and a ¼" rabbet along the back edge, where dimensioned on **Drawing 1**, noting that the parts are mirror images. Using a ¼" dado blade in your tablesaw and an auxiliary extension on your miter gauge to prevent chip-out, cut the ¼"-deep dadoes. Then, using an auxiliary fence attached to your rip fence, cut the ¼"-deep rabbets.

3 Using the same tablesaw setup, cut ¼" rabbets ¼" deep on the ends of the shelves (B), where shown on **Drawing 2**, to fit the dadoes in the sides (A).

ASSEMBLE THE CASE

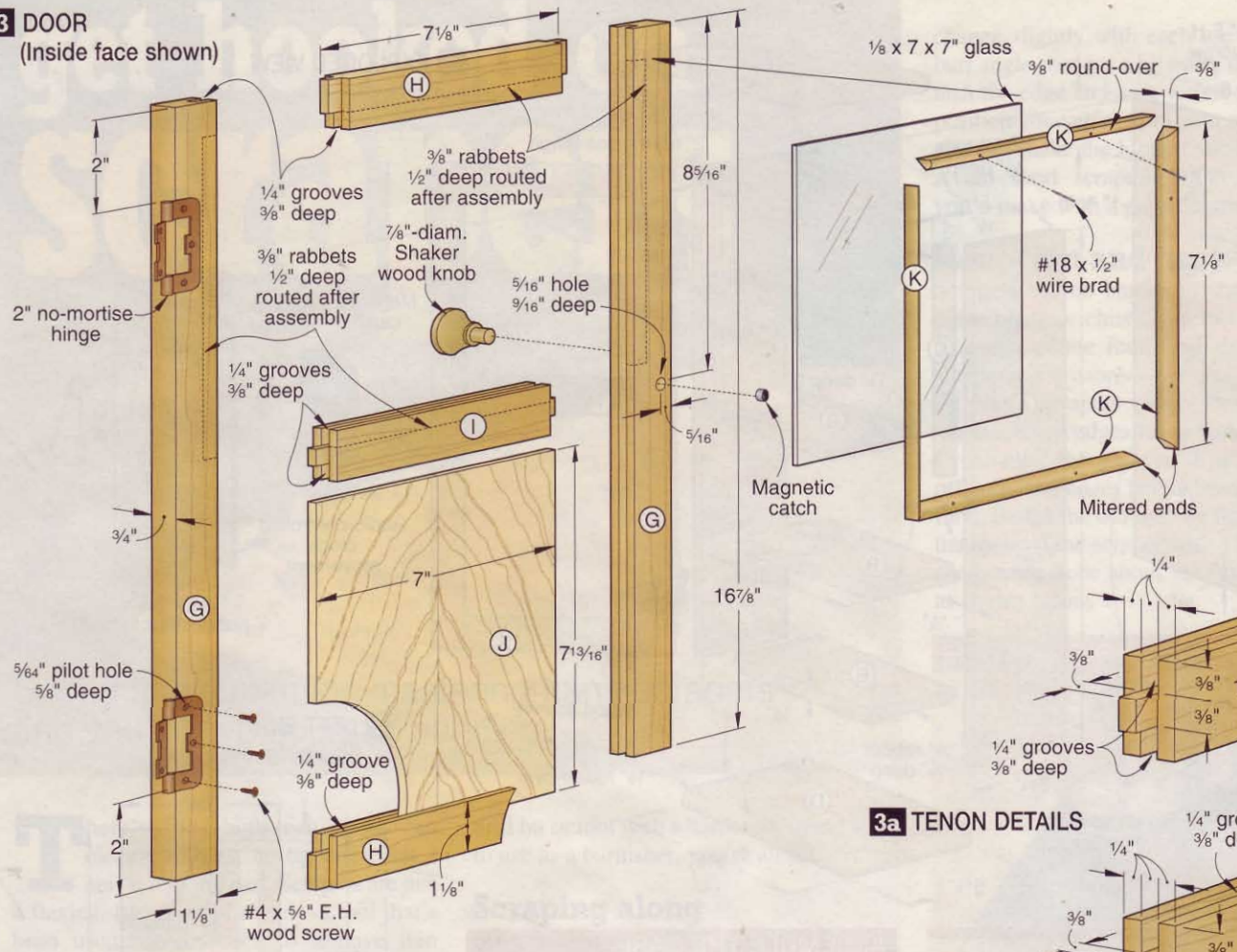


A

Glue and clamp the sides (A) and shelves (B) together. Verify square by checking for equal diagonal measurements.

4 Sand the sides and shelves with 220-grit sandpaper. Then assemble the case, as shown in **Photo A**, making sure the rabbets on the top and two middle shelves face up and on the bottom shelf face down.

5 From ¾" stock planed to ½" thick, cut the clock-face mounting blocks (C) to



size to fit between the top and upper middle shelves (B), where shown on **Drawing 2**. Glue and clamp the blocks to the sides (A).

6 From ¾" stock planed to ⅝" thick, cut the top and bottom (D) to size. Using a ½" round-over bit in your table-mounted router and a pushblock for safety and chip-out avoidance, rout the ends and then the front edge of the parts, where shown on **Drawing 2**.

7 Sand the top and bottom smooth. Then glue and clamp them to the case, flush at the back and centered side-to-side.

8 From ¼" walnut plywood, cut the back (E) to size to fit the rabbeted opening in the back of the case. Mark a centerpoint for a 1" finger hole in the back, where dimensioned on **Drawing 2**. Using a 1" Forstner bit in your drill press and a backer to prevent tear-out, drill the hole. Now sand the back, and set it aside.

9 Also from ¼" walnut plywood, cut a 7⅝x7⅝" piece for the clock-face backer (F). Draw diagonals on one face to find the center. Then drill a ⅝" hole through the center to receive the clock-movement stem. Apply spray adhesive to the backer and position the paper clock face on it, aligning the center holes.

Now craft a beautiful door

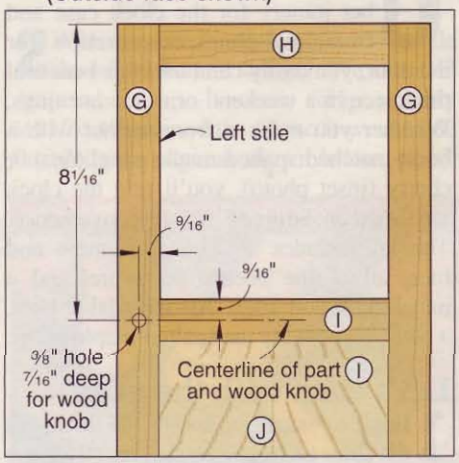
1 From ¾" stock, cut the stiles (G), top/bottom rails (H), and center rail (I) to the sizes listed. Save your cutoffs for making test tenons.

2 Fit your tablesaw with a ¼" dado blade. Then cut a ⅜"-deep groove centered along the inside edge of the stiles (G) and top/bottom rails (H), and along both edges of the center rail (I), where shown on **Drawings 3** and **3a**.

3 To form ¼" tenons ⅜" long on the rails, where shown on **Drawing 3a**, lower the dado blade to ¼" and position your rip fence ⅜" from the outside of the blade. (We made test tenons on our cutoffs and verified their fit in the grooves in the stiles before cutting the tenons on the rails.) Then cut the tenons, as shown in **Photo B**.

4 Resaw a ¾x4x12" piece of spalted maple or other figured wood to make a book-matched panel (J). (Optionally, you can make a solid panel by planing stock to ¼" thick and then cutting it to the finished size of 7x7¹³⁄₁₆".) Edge-glue the pieces together, aligning the grain as closely as you can. Plane the panel to ¼" thick to fit the grooves in the stiles (G) and rails (H, I). Then cut the panel to the finished size. For help on making book-matched panels, see the article on *page 28*. Sand the panel smooth to 220 grit.

3b DOORKNOB LOCATION
(Outside face shown)



5 To position the center rail (I) in the door, mark centerlines on masking tape on the *outside* face of the rail at the ends. Also, referring to **Drawing 3b**, mark alignment lines on the *outside* face of the stiles

What makes the radio-controlled clock tick?

Powered by a 1.5-volt AA-size battery, the radio-controlled clock contains a special AM receiver tuned to receive a time signal. This signal, transmitted from radio station WWVB near Fort Collins, Colorado, by the National Institute of Standards and Technology, is synchronized to the world's most accurate timepiece—a cesium fountain atomic clock. This clock maintains the country's official time with an amazing accuracy of one second in 40 million years.

After initial setup to your local time zone, the receiver automatically searches daily for the broadcast signal and calibrates itself as needed to maintain the precise time. The clock also automatically adjusts for daylight saving time changes in the spring and fall, but you easily can bypass this feature if you live in an area that does not observe these changes.

WWVB has a transmission radius of approximately 1,800 miles. The radio-controlled clock will work in most parts of the United States and Canada except for Hawaii, Alaska, part of the Maritime Provinces, and all of Newfoundland. For more information on the radio station or help on signal reception problems, go to http://tf.nist.gov/stations/wwvb.htm.

(G) 8 1/16" from the top ends. Dry-assemble the stiles, rails (H, I), and panel (J), aligning the marks on the center rail and stiles. Verify the parts fit together correctly. Then glue and clamp the door, as shown in **Photo C**. After the glue dries, sand the door.

6 Rout a 3/8" rabbet 1/2" deep around the top opening of the door on the *inside* face for the glass and glass stops (K), where shown on **Drawing 3**. (This removes the inside lips of the 1/4×3/8" grooves in the door.) To avoid chip-out, rout the opening in two passes. Then square the corners with a chisel.

7 To mount a 7/8"-diameter Shaker wood knob on the door, where shown on **Drawing 3**, mark a centerpoint for a 3/8" hole on the *outside* face of the left stile (G), where dimensioned on **Drawing 3b**. Using a 3/8" Forstner bit, drill a 7/16"-deep hole. Sand the knob. Then glue it in place.

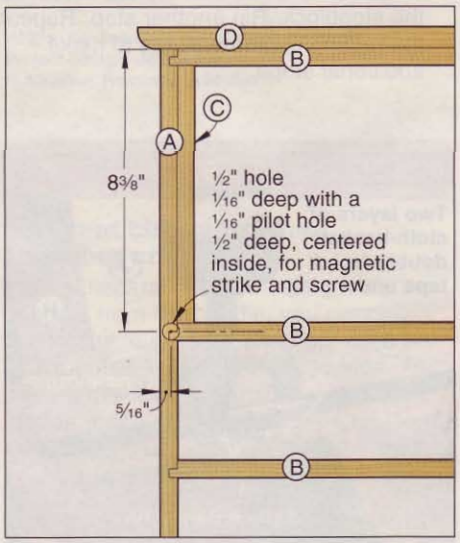
8 To install a magnetic catch and strike for the door, where shown on **Drawing 2**, mark a centerpoint for the catch on the *inside* of the left stile (G), where dimensioned on **Drawing 3**. Using a 5/16" brad-point bit, drill a 9/16"-deep hole in the stile. Then press in the catch. Next, mark a centerpoint for the strike on the front edge of the left case side (A), where dimensioned on **Drawing 4**. Using a 1/2" Forstner bit, drill a 1/16"-deep hole. Now drill a 1/16" pilot hole 1/2" deep centered in the hole. Set the strike plate and attaching screw aside.

9 To make the glass stops (K), where shown on **Drawing 3**, plane or resaw a piece of 3/4×4×12" stock to 3/8" thick. Then rout and rip four stops from this blank as explained in the first of the three **Shop Tips** on *page 74*. You'll miter-cut the stops to length to fit the door opening later.

Time to finish up

1 Finish-sand any areas that need it, and remove the dust. Apply three coats of a clear finish to the door, back (E), and the case, except for the front face of the clock-face mounting blocks (C). (We used Deft aerosol Satin Clear Wood Finish, sanding to 320 grit between coats.)

4 MAGNETIC-CATCH STRIKE-PLATE LOCATION



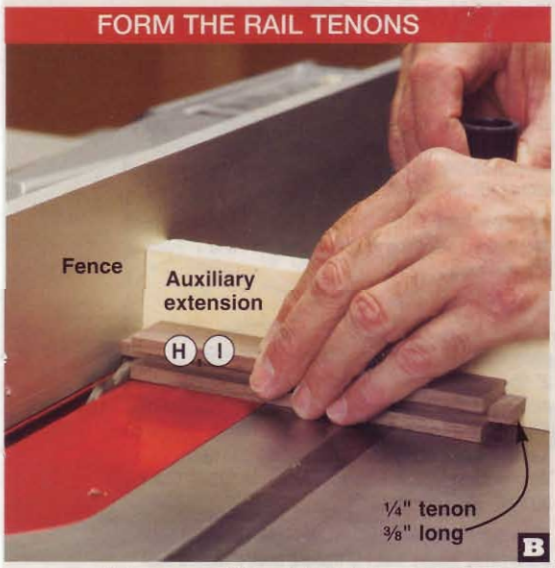
2 Have 1/8" glass cut to 7×7". Clean and place it in the rabbeted door opening. Then miter-cut the four glass stops (K) to length to fit the opening. Attach the stops to the door with #18×1/2" wire brads where shown on **Drawing 3** and as explained in **Shop Tips 2** and **3**. Set the brads, and fill the holes with a matching wood putty.

3 Drill pilot holes, and screw a pair of 2" no-mortise hinges on the *inside* of the door, where dimensioned on **Drawing 3**.

4 To attach the door to the case, place the case faceup on your workbench. Apply two layers (for best adhesion) of cloth-backed double-faced tape to the case side of the small hinge leaves. Next, position the door on the case, flush with the sides (A) and centered between the top and bottom (D). Press firmly on the door to adhere the taped hinge leaves to the case. Then carefully open the door, drill pilot holes, and fasten the hinges, as shown in **Photo D**. Now remove the door and tape, and remount the door.

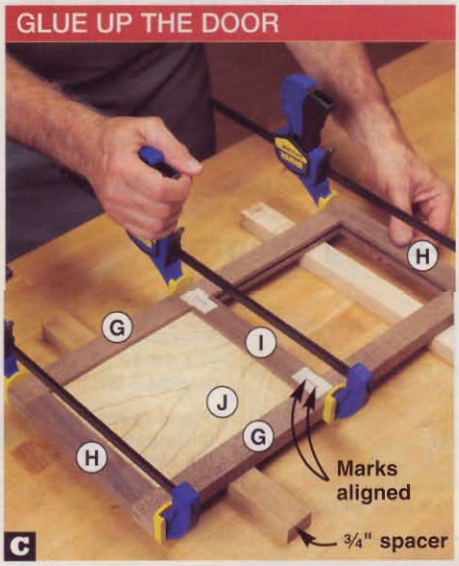
5 Mount the magnetic strike in its hole in the side (A) using the supplied screw.

FORM THE RAIL TENONS



Using an auxiliary extension on your miter gauge for backup and your rip fence as a stop, form 3/8"-long tenons on the rails (H, I).

GLUE UP THE DOOR



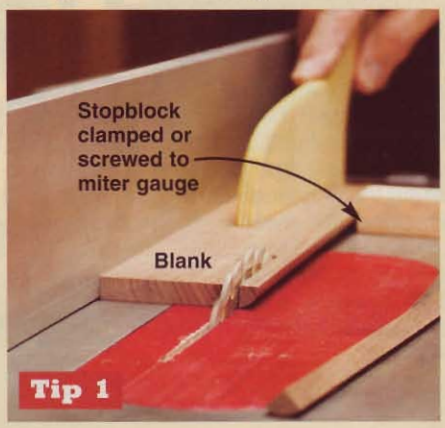
Glue and clamp the door together, checking for square. Place scrap 3/4" spacers under the door to center the clamping pressure.

3 SHOP TIPS

How to easily make and install small quarter-round glass stops

Tip 1 For safety when making narrow glass stops, such as the ⅜"-wide stops (K) for the Shaker-clock door, prepare an oversize blank planed to the thickness of the parts. Using your table-mounted router and a round-over bit (⅜" for the clock glass stops), rout both long edges of the blank.

Position your tablesaw fence to rip a stop of the needed width (⅜" for the clock) from the blank. To produce identical-width stops, position a stopblock against the blank, and clamp or screw the stopblock to your miter gauge. Rip a stop from the blank. Then turn the blank end-for-end with the cut edge against the fence. Slide the fence and blank over so that the blank touches the stopblock. Rip another stop. Repeat the routing/ripping process to make additional stops.



Tip 2 To prevent splitting the stops when attaching them with brads, predrill angled pilot holes in the stops using a brad with its head snipped off. So you'll be able to chuck the brad into your drill, use a brad that is ½" longer than the ones you'll drive into the stops.

Tip 3 To protect the glass when drilling and driving the brads, place a piece of ⅛" hardboard or cardboard on the glass.

MOUNT THE DOOR

Using a self-centering bit, drill pilot holes through the small leaves of the hinges into the sides (A). Then drive the screws.

6 With the clock faceup on your workbench, apply glue to the clock-face mounting blocks (C). Then position the clock face in the case. Place a two-pound object on the face, centering it to evenly distribute the weight while the glue dries.

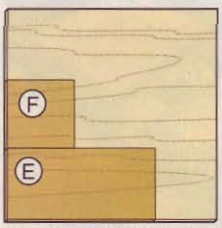
7 Position the back (E) in place with the finger hole at the top. Drill mounting holes through the back and into the case, where dimensioned on **Drawing 2**. Remove the back.

8 As directed in the instructions supplied with the clock and using the included hardware, mount the movement and hands, install a AA-size battery and activate the clock, find the location where it will receive the strongest signal (ideally facing the general direction of Colorado), and allow it to synchronize to the broadcast time signal. Avoid locating the clock within 3' of electronic appliances, fluorescent lights, power lines, and metal siding that can interfere with signal reception. Note that electronic "pollution" in urban areas during the day can affect reception. Reception generally is better at night and in cloudy weather.

9 Finally, screw the back (E) in place. Now when someone asks "Does anyone know the time?" you can look at your master timepiece and answer—with confidence—"It's *precisely*..."

Written by **Owen Duvall** with **Chuck Hedlund**
Project design: **David Denby, Versailles, Kentucky,** with **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Buck Jones**

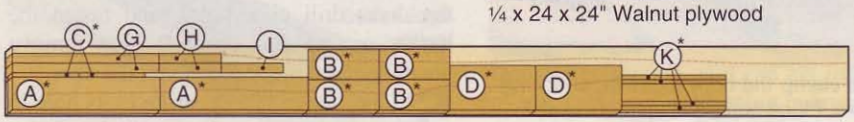
Cutting Diagram



¼ x 24 x 24" Walnut plywood

¾ x 4 x 12" Spalted maple (.3 bd. ft.)

*Plane or resaw to the thicknesses listed in the Materials List.



¾ x 7¼ x 96" Walnut (5.3 bd. ft.)

Materials List

Case	FINISHED SIZE T	W	L	Matl.	Qty.
A sides	½"	3¾"	17"	W	2
B shelves	½"	3½"	8⅛"	W	4
C clock-face mounting blocks	½"	½"	7⅝"	W	2
D top and bottom	⅝"	5⅛"	9⅞"	W	2
E back	¼"	8⅛"	17"	WP	1
F clock-face backer	¼"	7⅝"	7⅝"	WP	1
Door					
G stiles	¾"	1⅛"	16⅞"	W	2
H top/bottom rails	¾"	1⅛"	7⅛"	W	2
I center rail	¾"	1⅛"	7⅛"	W	1
J* book-matched panel†	¼"	7"	7 3/16"	SM	1
K* glass stops	⅜"	⅜"	7⅛"	W	4

*Parts initially cut oversize. See the instructions.

†As an option, you can make a solid walnut panel.

Materials key: W–walnut, WP–walnut plywood, SM–spalted maple.

Supplies: Spray adhesive, ⅛x7x7" glass, wood putty (color to match stock), cloth-backed double-faced tape, AA-size battery, #18x½" wire brads, #4x½" flathead wood screws (5), and #4x⅝" flathead wood screws (10).

Blades and bits: Dado-blade set; ⅜" and ½" round-over and ⅜" rabbeting router bits; ⅜", ½", and 1" Forstner bits; 5/16" brad-point bit.

Sources

Clock kits. Kits include a magnetic catch with strike plate, matching ⅞"-diameter Shaker wood knob, 2" no-mortise hinges (1 pr.), radio-controlled clock movement, and 7⅝x7⅝" paper clock face. Order kit no. SK-WAL (includes a walnut knob) or kit no. SK-CH (includes a cherry knob), $26.95 ppd. Schlabaugh and Sons Woodworking, 720 14th Street, Kalona, IA 52247. Call 800/346-9663; schsons.com.

Spalted-maple blank. ¾x4x12" spalted-maple blank (while supply lasts) to make a book-matched door panel for a walnut clock case, kit. no. LP-10, $7.95 ppd. from Schlabaugh and Sons. Addresses and telephone number *above*.

movies music & more

media storage

Keep videos, CDs, and DVDs organized and out of sight in this compact yet accommodating unit. Adjustable shelves and dividers in the case and doors let you configure the interior to suit your collection.

For the board feet of lumber and other items needed to build this project, see *page 81*.

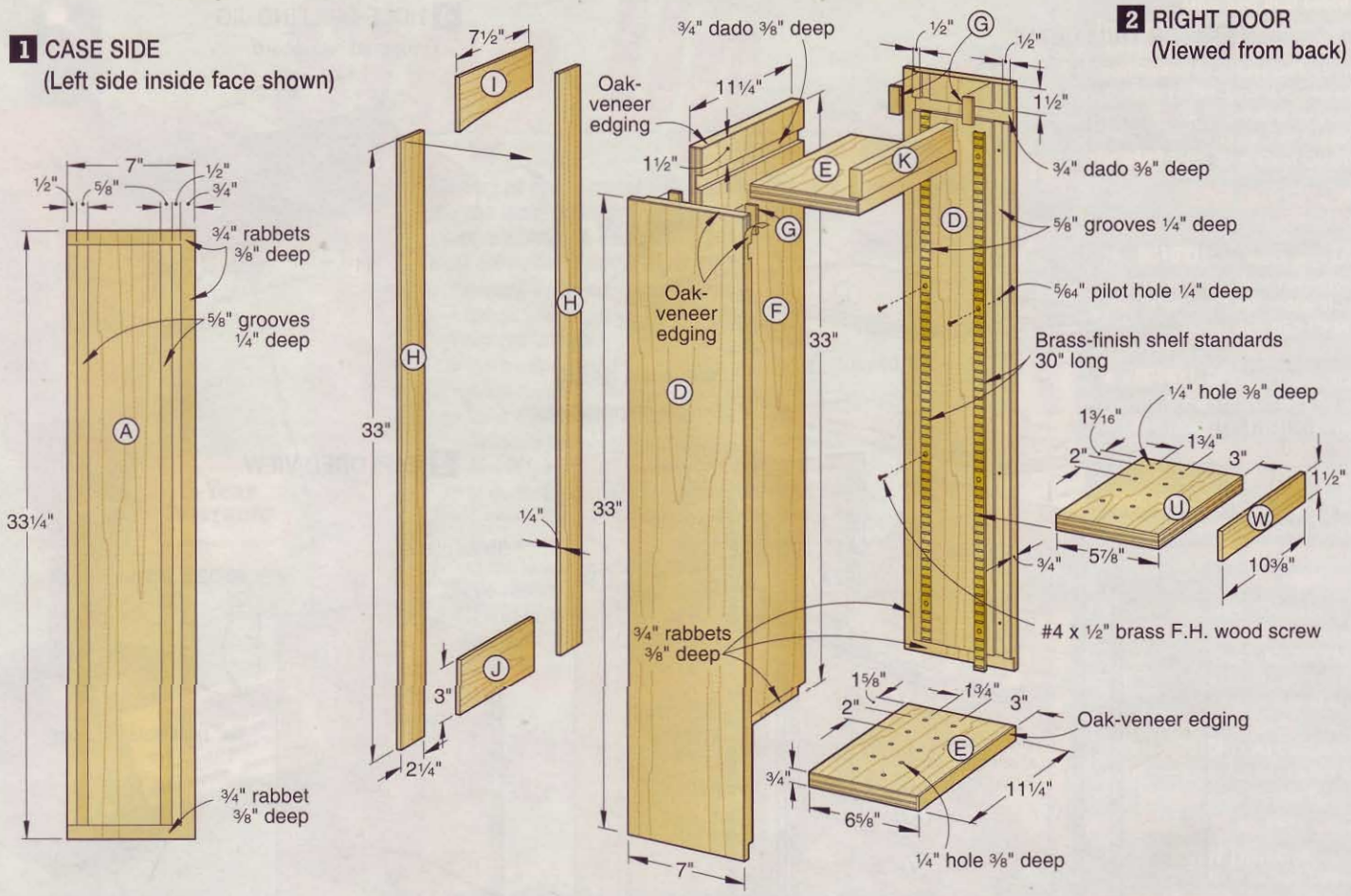
Need a centralized home for your electronic media? This easy-to-build storage cabinet fills the bill with capacity and style to spare. Though it measures just 26⅝" wide by 15 11/16" deep by 39¼" high, it holds hundreds of items. Better yet, you'll find *everything* you need to make it at your local home center.

First up: the case and doors

1 From ¾" plywood (we used red oak), cut the case sides (A), top and bottom (B), and back (C) to the sizes listed in the **Materials List**. Then cut the door sides (D), tops and bottoms (E), and fronts (F) to size.

2 Using a ⅝" dado blade in your tablesaw, cut ¼"-deep grooves for shelf standards in the case sides (A), where dimensioned on **Drawing 1**, and in the door sides (D), where dimensioned on **Drawing 2**. Note that the parts are mirror images.

With the doors closed, your collection is concealed, centralized, and orderly.



3 To form the fillers (G) for the top of the grooves in the door sides (D), plane or resaw a ¾×2×20" piece of stock to ¼" thick. Rip a ⅝"-wide strip from the blank. Then crosscut eight 2"-long fillers from the strip. Now glue a filler in each groove flush with the top of the door sides. You'll trim the fillers to the finished length of 1½" when you cut dadoes in the sides for the tops (E), ensuring a tight fit against the tops.

4 Apply 13⁄16"-wide adhesive-backed oak-veneer edging to the front edges of the

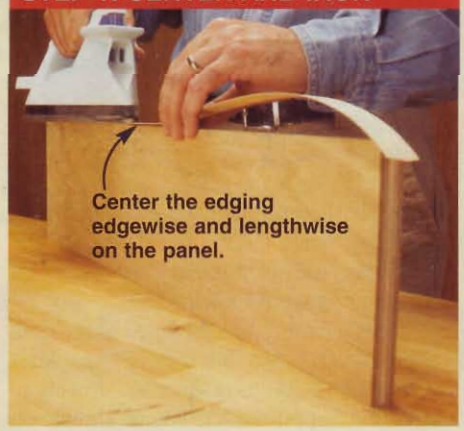
Adhesive-backed veneer edging: Great looks in 3 easy steps

To keep construction of the media cabinet simple, Senior Design Editor Kevin Boyle used adhesive-backed veneer edging instead of solid-wood edging for the case and door plywood panels. Veneer edging offers durability and the same finished look yet attaches much easier and faster.

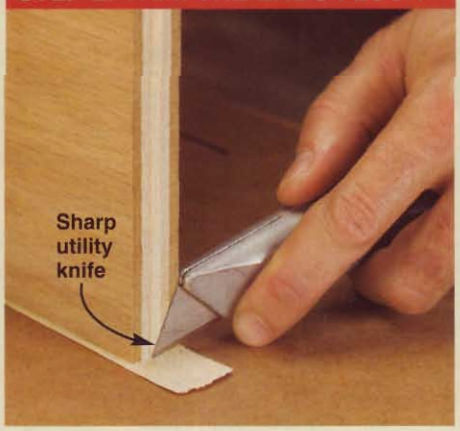
To ensure the veneer adhesive bonds strongly, vacuum the panel edges to remove all of the dust. Using a utility knife, cut the edging about 2" longer than the panel. Center the edging on the panel edgewise and lengthwise. Using a household iron at the cotton heat setting *without* steam, press the veneer in place, as shown in Step 1. Move the iron slowly enough to melt the adhesive (it takes only a few seconds) without burning the veneer. A slight "give" as you iron and a small amount of squeeze-out indicate the glue has melted.

Trim the veneer ends flush with the panel, as shown in Step 2. Finally, flush-trim the edges using an edge trimmer, as shown in Step 3. A single-edge trimmer, available at your local home center, costs less than $10.

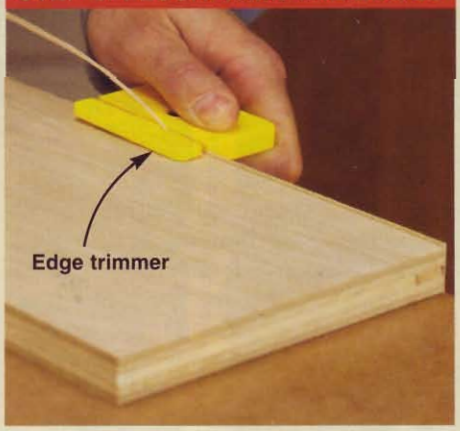
STEP 1: CENTER AND IRON

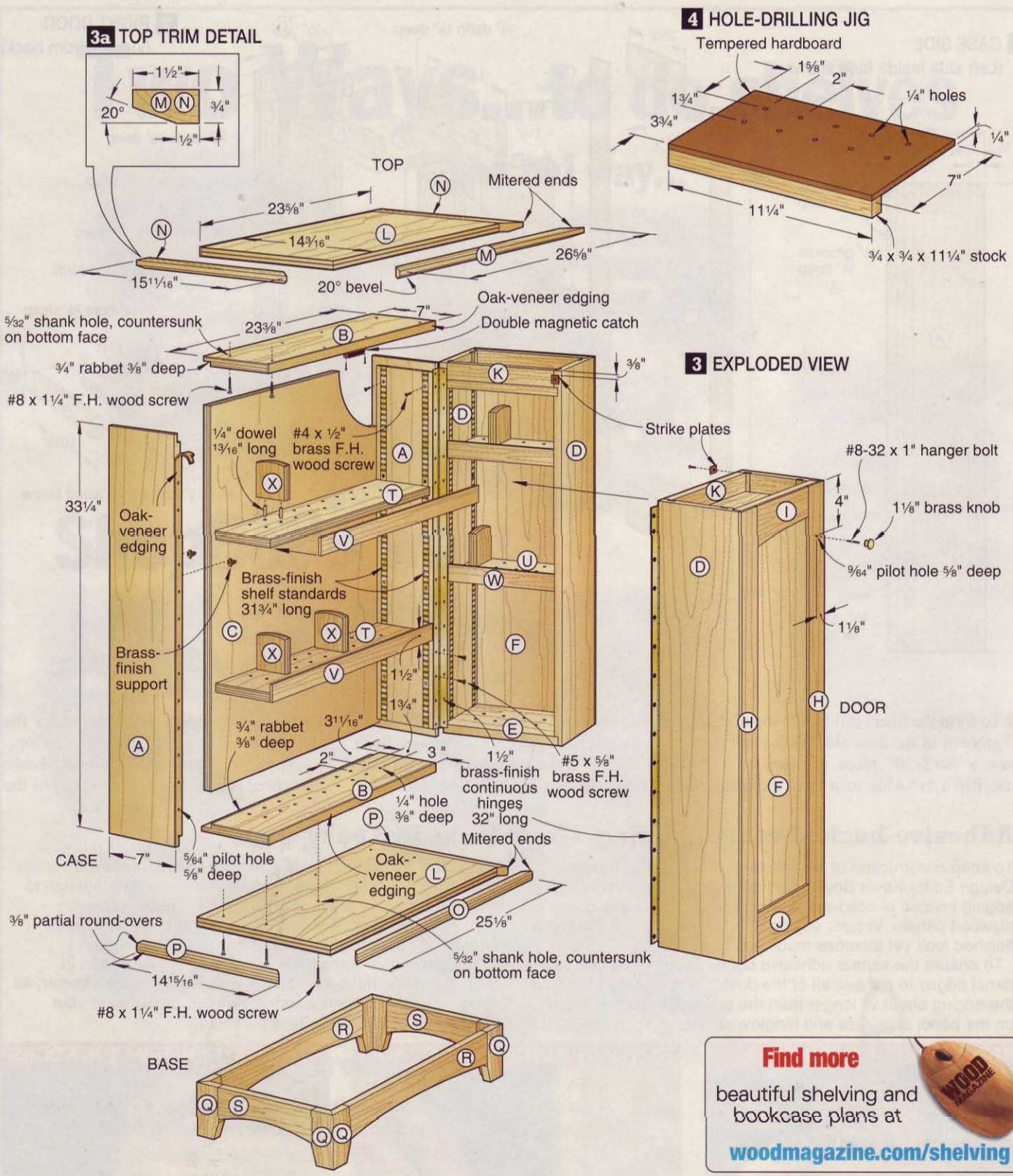


STEP 2: TRIM THE ENDS FLUSH



STEP 3: FLUSH-TRIM THE EDGES





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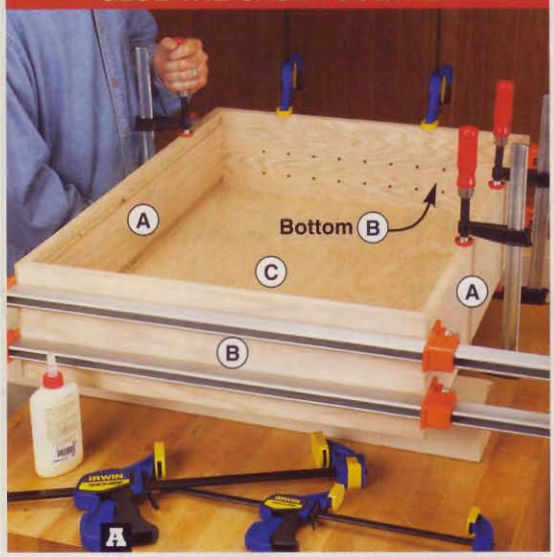
case sides (A) and top and bottom (B), where shown on **Drawing 3**. Also apply edging to the top ends of the door sides (D) and fronts (F) and the back (case side) edges of the door sides (D) and tops and bottoms (E), where shown on **Drawing 2**. For help on applying and trimming the edging, see the sidebar on the *previous page*.

5 Adjust your dado blade to match the thickness of your ¾" plywood. Then cut the ⅜"-deep rabbets in the case sides (A) and top and bottom (B), where shown on **Drawings 1** and **3**, and in the door sides (D) and fronts (F), where shown on **Drawing 2**. Now cut the ⅜"-deep dadoes in the door sides and fronts to receive the tops (E), where dimensioned. To avoid chipping the edging when cutting the dadoes in the door sides, use an auxiliary extension on your miter gauge for backup.

6 To drill evenly spaced holes in the case bottom (B), door bottoms (E), and later the shelves (T, U) to receive ¼" dowels in the media supports (X), where shown on

GLUE THE CASE TOGETHER



Clamp together the case sides (A) and top and bottom (B) with the back (C) held tight in the rabbeted edges of the parts.

Drawing 3, build the simple hole-drilling jig shown in **Drawing 4**.

7 Position the jig on the *inside* face of a door bottom (E) with the ends flush and the jig stop tight against the veneered edge. Using a depth stop on your drill bit and the jig holes as guides, drill ¼" holes ⅜" deep in the door bottom, where dimensioned on **Drawing 2**. Repeat for the other door bottom. Next draw lines 3 11/16" from the ends on the *inside* face of the case bottom (B). Positioning the jig in the same way but with an outer pair of holes centered over one of the marked lines, drill holes in the case bottom, where dimensioned on **Drawing 3**. Shift the jig, and drill the remaining holes.

8 Apply glue in the rabbets in the case sides (A) and top and bottom (B). Assemble the case, as shown in **Photo A**, checking for square. Similarly, assemble the doors by gluing and clamping together the sides (D), tops and bottoms (E), and fronts (F).

Complete the doors

1 From ¾" stock planed to ¼" thick, cut the vertical trim (H), top horizontal trim (I), and bottom horizontal trim (J) to the sizes listed.

2 Make two copies of the full-size top horizontal trim pattern on the *WOOD Patterns*® insert. Spray-adhere the patterns to the trim, turning one of the copies over to create mirror-image parts. Bandsaw and sand the trim to the pattern lines. Remove the patterns using a cloth moistened with lacquer or paint thinner. Sand the parts with 220-grit sandpaper.

3 Glue and clamp the trim (H, I, J) to the fronts of the doors, where shown on **Drawings 2** and **3** and as shown in **Photo B**. On each door, make sure you position the top horizontal trim (I) with the narrow end of the arch adjacent to the *inside* vertical trim (H).

4 Cut the rails (K) to size. Then glue and clamp them in place on the door tops (E), where shown on **Drawing 2**, flush with the back edges of the tops.

On to the top/bottom panels

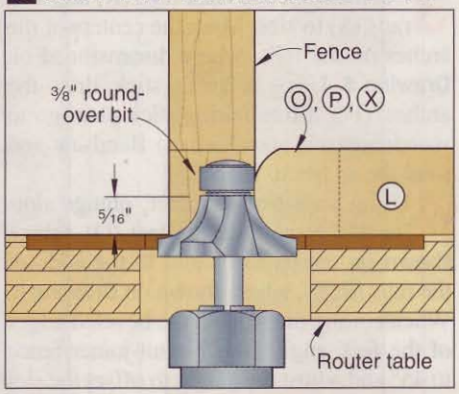
1 From ¾" plywood, cut the top and bottom panels (L) to size.

2 To form the top front trim (M) and side trim (N) for the top panel and the bottom front trim (O) and side trim (P) for the bottom panel, where shown on **Drawing 3**, plane a ¾×2½×64" piece of solid stock to match the thickness of the panels. Rip a ¾"-wide strip from the blank for the bottom trim. Joint the cut edge of the blank. Then rip a 1½"-wide strip for the top trim.

3 Miter-cut the front and side trim pieces to length from the strips to fit the panels. Glue and clamp the trim in place, verifying tight mitered corners.

4 To cut a 20° bevel along the bottom edges of the top front trim (M) and side trim (N), attach a 12"-tall auxiliary fence to your tablesaw rip fence to safely support the panel (L). Angle the saw blade to 20° from vertical, and position the fence to cut the bevel, where dimensioned on **Drawing 3a**. With the top face of the panel held tight against the auxiliary fence, bevel-rip the side trim and then the front trim. Sand smooth.

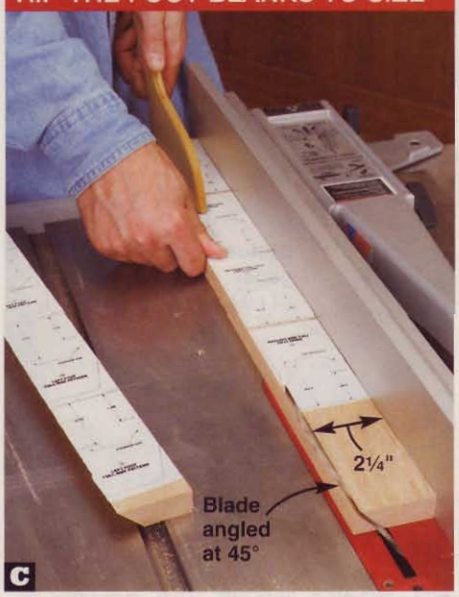
5 ROUT THE PARTIAL ROUND-OVERS



ADD THE TRIM TO THE DOORS

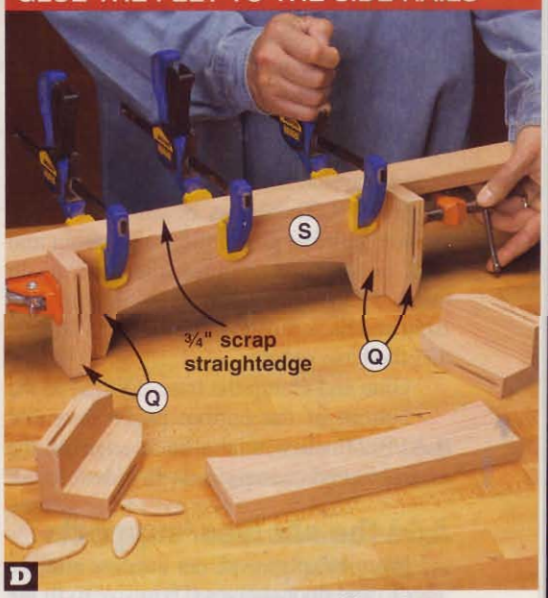
Using ¾" scraps to spread the clamping pressure, attach the trim (H, I, J) to the front of the door, keeping the outer edges flush.

RIP THE FOOT BLANKS TO SIZE



With your tablesaw blade angled 45° from vertical, bevel-rip the foot blanks to the finished width of 2¼".

GLUE THE FEET TO THE SIDE RAILS



Glue, biscuit, and clamp the feet (Q) to the ends of the side rails (S). Use ¾" scrap as a straightedge to keep the parts aligned.

5 To create a bullnose profile on the bottom front trim (O) and side trim (P) on the bottom panel (L), rout partial ⅜" round-overs along the trim using your table-mounted router and a ⅜" round-over bit in the setup shown on **Drawing 5**. Set the panels aside.

Time for the base

1 From ¾" stock, cut two 2½×22" blanks to form the feet (Q). Make four copies each of the full-size left and right foot patterns. Spray-adhere the left foot patterns to one blank and the right foot patterns to the other blank, aligning the sides of the patterns that have the angled bottoms (opposite the sides that get the 45° bevels) with an edge of each blank.

2 Bevel-rip the inside edge of the foot blanks to the finished width of 2¼", as shown in **Photo C** on *page 79*. Then crosscut four 4½"-long feet from each blank. Using a disc sander with 120-grit sandpaper or a vise-mounted belt sander, sand the angled bottoms to the pattern lines. Do not remove the patterns.

3 Cut the front and back rails (R) and side rails (S) to size. Mark the centers of the arches on the rails, where dimensioned on **Drawing 6**. Using a fairing stick, draw the arches. (For a free fairing stick plan, go to woodmagazine.com/fairing.) Bandsaw and sand the arches to shape.

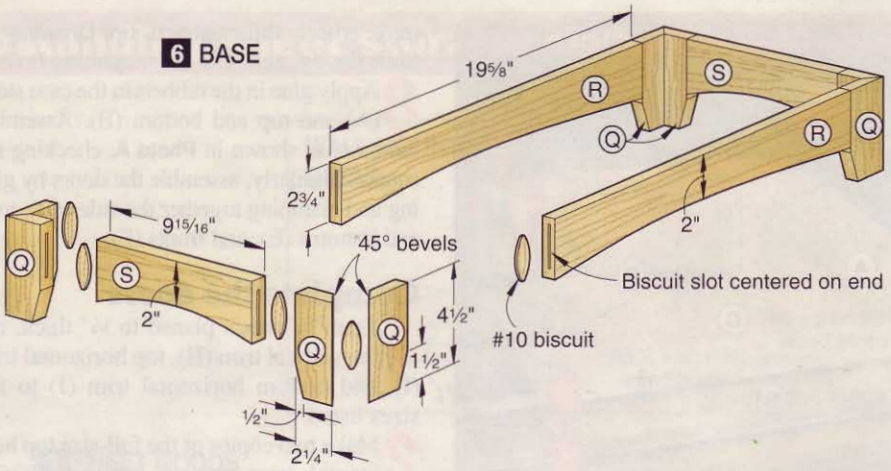
4 Using your biscuit joiner, plunge slots for #10 biscuits in the feet (Q), where shown on the patterns, and in the ends of the rails (R, S), where shown on **Drawing 6**. When cutting the slots in the beveled edges of the feet, angle your biscuit-joiner fence to 45° and adjust the height to offset the slot cutter toward the inside faces of the feet to ensure the cutter does not go through the outside faces. (We cut slots in scrap first to verify the setting.) Remove the patterns.

5 Glue, biscuit, and assemble the beveled edges of the left and right feet together. After the glue dries, assemble the feet to the ends of the side rails (S), as shown in **Photo D** on *page 79*. Then glue, biscuit, and clamp the side rail/feet assemblies to the front and back rails (R) to complete the base, again using straightedges clamped against the front and back rails to keep the parts aligned and the base square.

6 Glue and clamp the base (Q/R/S) to the bottom of the bottom panel assembly (L/O/P), flush with the back edge of the assembly and centered side-to-side.

Add the shelves/supports

1 From ¾" plywood, cut the case shelves (T) and door shelves (U) to size to fit the openings. Using the hole-drilling jig, drill ¼" holes ⅜" deep in the case shelves, where dimensioned on **Drawing 7**, and in the door shelves, where dimensioned on **Drawing 2**.



2 From ¾" stock planed to ¼" thick, cut two 1½×72" blanks to form the case shelf trim (V) and door shelf trim (W). Cut three 22½"-long pieces from one blank for the case shelf trim and six 10⅜"-long pieces from the other blank for the door shelf trim. Glue and clamp the trim to the shelves, flush with the ends and bottoms.

3 Cut the media supports (X) to size. Then drill ¼" holes ½" deep in the bottoms of the supports, where dimensioned on **Drawing 7**, to receive ¼" dowels, where shown on **Drawing 3**. From a ¼" hardwood dowel 20" long and using a handsaw, cut eighteen pieces 1³⁄₁₆" long. Glue the dowels in the supports.

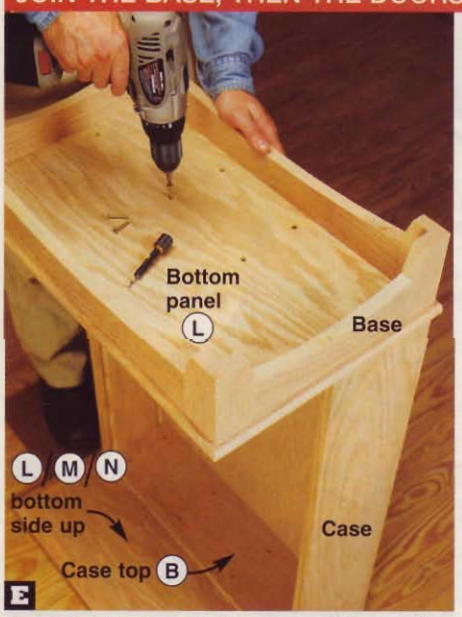
4 Using a fairing stick, mark the arch on the top of a support, where dimensioned on **Drawing 7**. Bandsaw and sand the arch smooth. Using this support as a template, mark the arch on the other supports. Then cut and sand them to shape. To create a bullnose profile along the edges of the supports where shown, rout partial ⅜" round-overs using the setup shown on **Drawing 5**.

Finish up

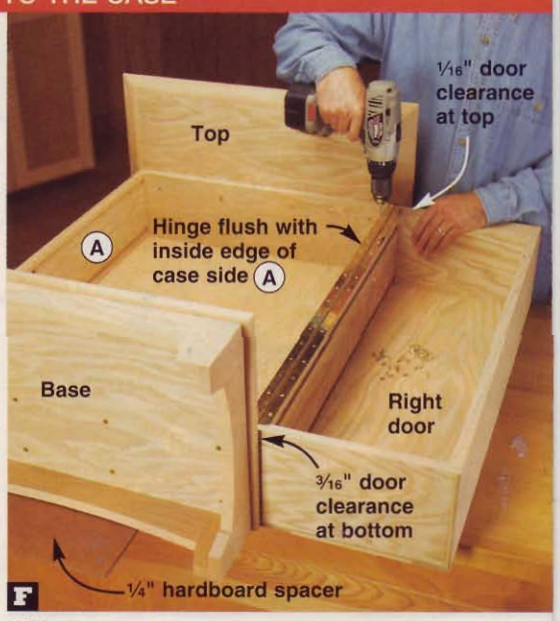
1 Place the top panel assembly (L/M/N) on the floor with the *bottom* side up. Then position the case, with the top (B) down, on the panel assembly, flush with the back edge and centered side-to-side. Drill mounting holes through the top and into the panel, where shown on **Drawing 3**. Now drive the screws. In the same way, position the base assembly (L/O/P/Q/R/S) on the case, and secure it as shown in **Photo E**.

2 To mount the doors to the case, hacksaw two 32"-long pieces from two 1½×36" brass-finish continuous hinges.

JOIN THE BASE, THEN THE DOORS, TO THE CASE

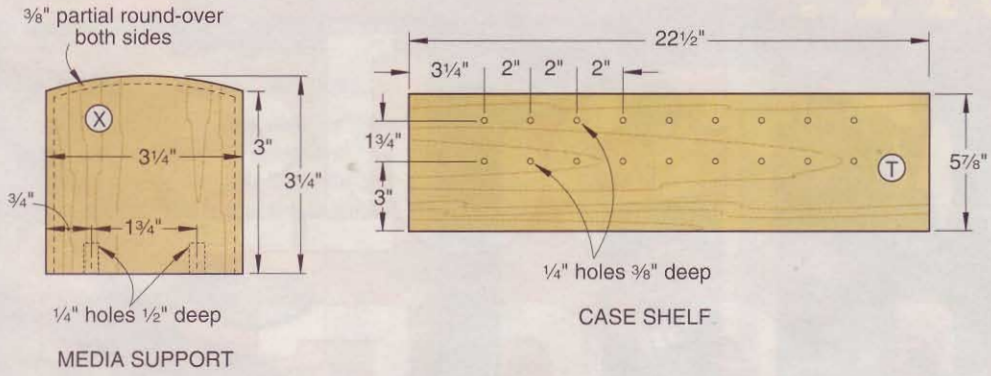


To fasten the base to the case, drill mounting holes through the bottom panel (L) into the case bottom (B), and drive the screws.



With the case on a ¼" hardboard spacer and the door correctly aligned, drill mounting holes and screw the hinge to the case.

7 PARTS VIEW



Referring to **Drawing 3**, position the hinges on the *outer* door sides (D), flush with the inside edges and centered top-to-bottom. Drill mounting holes, and drive the screws.

3 Place the case with the back down on a scrap piece of ¼" hardboard on your workbench. (This levels the case with the doors.) Position a door adjacent to the case with the continuous hinge flush with the inside edge of the side (A) and 1/16" clearance at the *top* and 3/16" clearance at the *bottom* with the case opening. (Offsetting the door in the opening allows it to center when loaded with videos and CDs.) Now attach the door, as shown in **Photo F**. Repeat for the other door.

4 Mount a double magnetic catch on the bottom face of the top (B), centered and flush with the front edge, where shown on **Drawing 3**. Then mount the mating strike plates on the doors, where dimensioned.

5 To mount 1⅛" brass knobs on the doors, drill 9/64" pilot holes ⅝" deep through the inside vertical trim (H) and into the plywood fronts (F), where dimensioned on **Drawing 3**. Drive #8-32×1" hanger bolts in the holes. Then thread the knobs on the bolts.

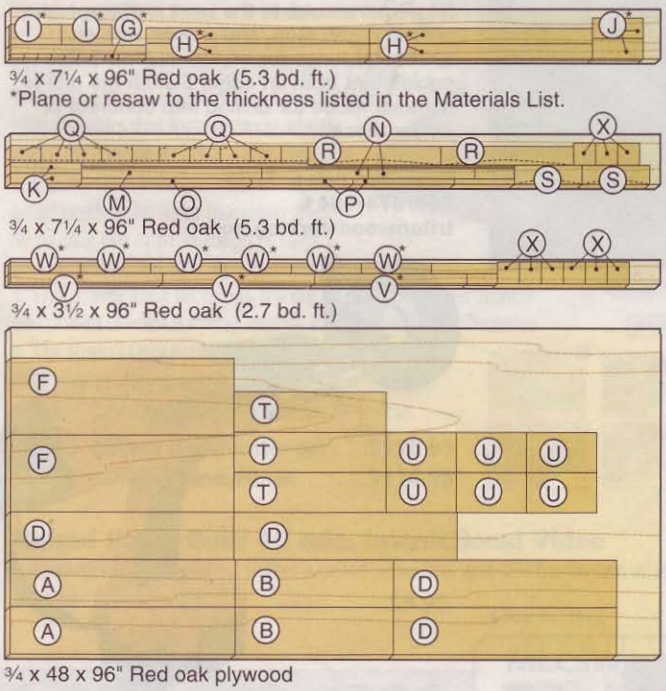
6 From six brass-finish shelf standards 72" long, hacksaw four 31¾"-long pieces for the case and eight 30"-long pieces for the doors (four each). Note the inch markings on the standards, and make sure you cut and install them so the slots for the shelf supports align. Position the standards in the grooves, drill pilot holes, and screw them in place.

7 Remove all hardware. Sand the case, doors, shelves, and media supports (X) to 220 grit, and remove the dust. Sand the thin veneer edging only with a sanding block and light pressure. Apply a stain if you wish. (We used Zar Oil-Based Stain, no. 110 Salem Maple.) Then apply three coats of a clear finish. (We used AquaZar Water-Based Clear Satin Polyurethane, sanding to 320 grit between coats.)

8 Finally, reinstall the hardware and mount the doors. Install the case shelves (T/V) and door shelves (U/W) where desired using brass-finish supports. Now round up your videos, CDs, and DVDs, and load the unit, positioning the media supports (X) where needed in the shelves.

Written by **Owen Duvall** with **Kevin Boyle**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**

Cutting Diagram


I* I* G* H H J*
¾ x 7¼ x 96" Red oak (5.3 bd. ft.)
*Plane or resaw to the thickness listed in the Materials List.
Q Q N R R X K M O P S S
¾ x 7¼ x 96" Red oak (5.3 bd. ft.)
W* W* W* W* W* W* X X V V V
¾ x 3½ x 96" Red oak (2.7 bd. ft.)
F T F T U U U T U U U D D A B D A B D
¾ x 48 x 96" Red oak plywood
C
¾ x 24 x 48" Red oak plywood
L E L E E L E
¾ x 24 x 48" Red oak plywood

Materials List

Case	FINISHED SIZE T	W	L	Matl.	Qty.
A sides	¾"	7"	33¼"	OP	2
B top and bottom	¾"	7"	23⅜"	OP	2
C back	¾"	23⅜"	32½"	OP	1
Doors (two needed)					
D sides	¾"	7"	33"	OP	4
E tops and bottoms	¾"	6⅝"	11¼"	OP	4
F fronts	¾"	11¼"	33"	OP	2
G* fillers	¼"	⅝"	1½"	O	8
H vertical trim	¼"	2¼"	33"	O	4
I top horizontal trim	¼"	3"	7½"	O	2
J bottom horizontal trim	¼"	3"	7½"	O	2
K rails	¾"	1½"	10½"	O	2
Top and bottom panel assemblies					
L top and bottom panels	¾"	14³⁄₁₆"	23⅜"	OP	2
M* top front trim	¾"	1½"	26⅝"	O	1
N* top side trim	¾"	1½"	15¹¹⁄₁₆"	O	2
O* bottom front trim	¾"	¾"	25⅛"	O	1
P* bottom side trim	¾"	¾"	14¹⁵⁄₁₆"	O	2
Base					
Q* feet	¾"	2¼"	4½"	O	8
R front and back rails	¾"	2¾"	19⅝"	O	2
S side rails	¾"	2¾"	9¹⁵⁄₁₆"	O	2
Shelves and media supports					
T case shelves	¾"	5⅞"	22½"	OP	3
U door shelves	¾"	5⅞"	10⅜"	OP	6
V* case shelf trim	¼"	1½"	22½"	O	3
W* door shelf trim	¼"	1½"	10⅜"	O	6
X media supports	¾"	3¼"	3¼"	O	9

*Parts initially cut oversize. See the instructions.

Materials key: OP–red oak plywood, O–red oak.

Supplies: 13/16"-wide adhesive-backed oak-veneer edging, 8' roll (4 rolls); spray adhesive; #10 biscuits (12); ¼" hardwood dowel 20" long; #8×1¼" flathead wood screws; 1½×36" brass-finish continuous hinges (2); double magnetic catch with strike plates (1); 1⅛" brass knobs (2); #8-32×1" hanger bolts (2); brass-finish shelf standards 72" long (6); #4×½" and #5×⅝" brass flathead wood screws; brass-finish supports (36).

Blades and bits: Dado-blade set, ⅜" round-over router bit.

HOT STUFF!

new tools for 2005

Take a sneak peek into the future of woodworking tools and vote on the ones you'd like us to shop-test.

The year 2005 may well go down as the year woodworking went digital. With electronic readouts on everything from dust collectors to mitersaws to router lifts, accuracy has never been more achievable. After scouring industry shows (and twisting the arms of some reluctant manufacturers), we came up with our wish list of 15 tools and accessories that promise to save you time, money, and maybe even a finger or two.

Most of these products were too new to test—some were only in the prototype stage—at the time this issue went to press, so we'd like your input on which ones you would most like to have tested in the *WOOD*® magazine shop. Just visit the *WOOD Online*® Web site at woodmagazine.com/hottools and pick your favorite five. We'll put the top vote-getters through their paces and include the results in upcoming issues.

ALL THE ANGLES, ALL UP FRONT

Hitachi takes the guesswork out of setting the angles on its C12LCH 12" compound mitersaw. The miter and bevel angles show up in a lighted digital display on the front of the saw (*inset*). And a built-in laser line easily adjusts to show either the left or right edge of the blade.

Expected price: $370
800/829-4752
hitachipowertools.com

BOLDLY GO WHERE NO DRILL PRESS HAS GONE BEFORE

If you can't take the workpiece to the drill press, take Triton's 18-volt Plunge Drill to the workpiece. Its spring-loaded base keeps the bit perpendicular to the work surface, has a built-in depth stop, and comes with an accessory fence for boring multiple holes equidistant from an edge. Switch the drill to hammer mode for drilling into concrete or cinder block.

Expected price: $290
888/874-8661
tritonwoodworking.com

DON'T STRESS ABOUT BANDSAW BLADE TENSION

From Carter Products, the people who brought you the quick-release blade tensioner, comes a handy digital gauge that shows the exact tension of your bandsaw blade. The Electronic Tension Gauge displays the tension in foot pounds and the instructions provide the correct tension for different blades. It fits most 14" bandsaws, with versions for 16" and 18" saws planned.

Expected price: $200
888/622-7837
carterproducts.com

PERFECTLY SIZED DADOES

Plywood is never as thick as they say and its true thickness can vary from sheet to sheet. Dadowiz, from Woodline USA, quickly creates perfect-fitting dadoes from ¼" to 1⅛" wide by using the plywood itself as a gauge. Once set, Dadowiz fits over your clamp-on tool guide, and your guide-bushing-equipped router cuts the dado in two easy passes.

Price: $140
800/472-6950
woodline.com

EFFORTLESS ROUTING WITH AIR

Replace your router's plastic subbase with the AirGlide aluminum and phenolic plate, hook up the plate's hose to an air compressor, and your router glides on a whisper-thin cushion of air. The result is less scratching on delicate surfaces, more accurate cuts, and reduced fatigue for you.

Price: $150
800/871-7516
betterleytools.com

ADD AN EXTRA MARGIN OF SAFETY WITH SAWSTOP

Four years ago (issue 131) we first told you about SawStop: a device that halts a tablesaw blade the instant it makes contact with skin, leaving you with a nicked digit instead of an accidental amputation. In 2005, you'll finally be able to buy SawStop-equipped saws that also include a quick-release riving knife (splitter). The fully loaded 3-hp cabinet saw will sell for about $2,800 with a 50" fence; the 1½-hp contractor-style unit, about $800.

Expected price: $800
503/638-6201
sawstop.com

READABLE, REPEATABLE ROUTER LIFT

We've seen a raft of new router lifts introduced this year, and the most sophisticated is the SmartLift Digital from JoinTech. The digital display shows the bit height in inches or millimeters and, because it measures movement of the router instead of turns of the crank, it's absolutely reliable. The manufacturer also created a unique drive mechanism they say eliminates annoying backlash. Out of the box, SmartLift fits Porter-Cable's 7518 with adapters available for many popular 1½- to 2-hp fixed-base routers.

Expected price: $390
800/619-1288
jointech.com

DUST COLLECTORS GO DIGITAL AND REMOTE

Specially equipped new dust collectors from Jet turn on and off with a remote control that slips easily into your pocket. That feature saves you both time and steps across the shop. The collector will even shut itself off after 1–99 minutes with its built-in timer.

Price: About $50 more than a nonremote-equipped Jet dust collector
800/274-6848
wmhtoolgroup.com

FREUD QUALITY FOR A THIRD FEWER $$

Recognizing that not every woodworker wants (or needs) to pay top-dollar for high-end router bits, Freud created the Avanti line of bits. Designed and manufactured in Italy by Freud, these bits lack the familiar red nonstick coating, have slightly thinner carbide (and so, fewer sharpenings), and sell for about 30 percent less than Freud's regular line of red bits. They also come with a CD-ROM full of set-up and use tips.

Expected price: 15-piece set, $200; 5-piece set, $70
800/472-7307
freudtools.com

PHENOLIC SLIDING TABLE CUTS WEIGHT

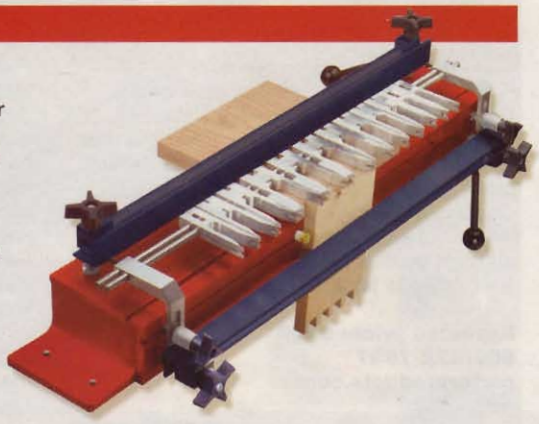
JessEm Tool, the company that brought you the original router lift, expands its offering of high quality tool accessories with a phenolic sliding table that fits on virtually any cabinet-style tablesaw. The massive miter gauge, with positive stops every 2½°, can be bought separately from the table for $125.

Expected price: $500
866/272-7492
jessem.com

DOVETAILS BY YOUR DESIGN

With Hart Design's new dovetail jig, you establish the size and spacing—even variable spacing—of the dovetails on your project, then use the included "keys" to precisely space the guide fingers for both the tail and pin cuts. This simple setup means you're ready to rout in just a few minutes. The GFK 2400 handles stock up to 24" wide, and also includes a template for ½" and ¼" half-blind joints.

Expected price: $300
800/345-2396
hartvilletools.com



ABRADE FOR THE RED, WHITE, AND BLUE

To ensure you're choosing the right sandpaper for the task at hand, Bosch color-codes its new abrasive line by the paper's best application, not by grit. Red abrasives are for wood, white works best for paint removal, and blue abrades metal. The code holds across a full complement of grits and formats including belts, discs, and sheets.

Price: varies by color and format
877/267-3499
boschtools.com

STAND SUPPORTS STOCK WITHOUT STEERING

The Ultimate Roller Stand from Lee Valley combines the best features of various support stands into one. For starters, its wide stance resists tipping, and a ramp on the infeed side gently guides a sagging workpiece onto the swiveling wheels (which *don't* direct the workpiece). Fine adjustment mechanisms and a leveler foot make it easy to match the stand to any shop floor or tool.

Price: $80
800/871-8158
leevalley.com

DRILL ACCESSORY REACHES AROUND CORNERS

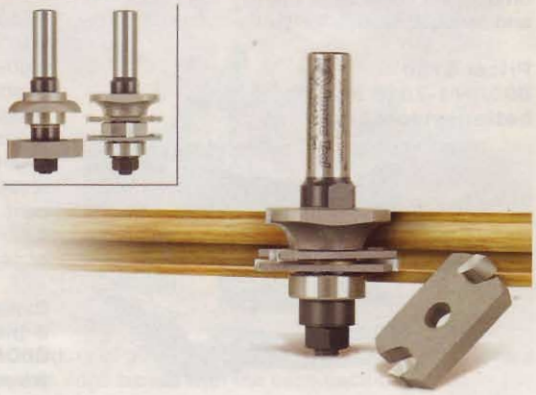
In tight spaces, a dedicated right-angle drill is handy, but not very economical unless you use it a lot. The Orbiter chucks into any ⅜" (or larger) drill and allows you to drill or drive at any angle from straight-on to perpendicular to the drill. Its big handle locks the angle and provides additional leverage.

Price: $30
815/874-2400
milescraft.com

RAIL-AND-STILE BITS FOR A CUSTOM FIT

Most rail-and-stile router bit sets use a ¼" or ½" cutter to make the slot for the panel, so today's undersize plywood rattles in a full-size slot. With Amana's In-Stile and Rail System, you can add or remove shims (like an adjustable slot cutter) to perfectly match your panel thickness from 3/16" to 9/32" for ¼" plywood and from 7/16" to 17/32" for ½" plywood. The bit set is available in three different profiles: concave, ogee, or bead.

Price: $155
800/445-0077
amanatool.com



four-in-one photo frame

Store about 50 of your favorite snapshots right in the frame, then change photos easily and quickly whenever you feel like it.

Mix or match seasonal, holiday, or event themes in this four-photo frame. Simple moldings glued to a plywood panel bring this project together in a flash. In the process, you'll learn how to make a simple jig that helps you produce flawless beveled moldings on a portable planer, a technique you're sure to find useful in future projects.

Build out from the back

1 Cut the back (A) to size, then lay out the four rectangular openings, where dimensioned on **Drawing 1**. Drill saw-blade start holes, and scrollsaw or jigsaw the openings, carefully following the lines. Sand the edges of the openings.

2 From ½" stock, cut the outer frame top and bottom (B) and outer frame sides (C) to the width and about 2" longer than the lengths listed on the **Materials List**. Measure the actual thickness of your ¼" plywood, then cut a ¼"-deep groove in each part, where shown on **Drawing 2a**. Chuck a ¼" cove bit in your table-mounted router and rout the edges of the parts, where shown. Finish-sand the parts.

3 Miter-cut the outer frame top and bottom (B) and outer frame sides (C) to finished length, checking their fit around the back (A). Apply glue in the frame part grooves and on the mitered ends, and clamp them to the back (A).

4 From ½" stock, cut the inner frame top and bottom (D) and inner frame sides (E) to the width and about 2" longer than the lengths listed. Finish-sand the parts, then miter-cut them to fit inside the outer frame, where shown on **Drawing 2**. Glue and clamp the inner frame in place.

Turn buttons make changing your photo display easy. And the ⅛" plywood backers leave plenty of room to store extra photos.

Add dividers and surrounds

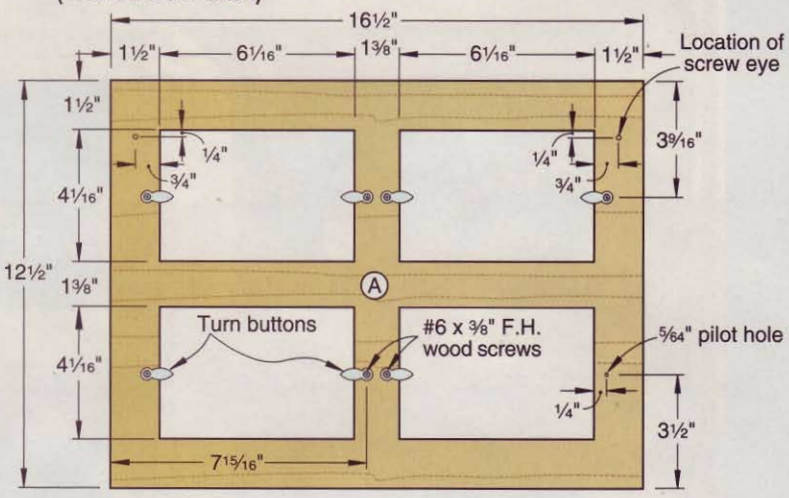
1 From ½" stock, cut the vertical divider (F) to snugly fit between the inner frame top and bottom (D), where shown on **Drawing 2**. Finish-sand the vertical divider, and center it between the inner frame sides (E). Cut the horizontal dividers (G) to snugly fit between the inner frame sides (E) and the vertical divider. Finish-sand the horizontal dividers, and center them, as shown in **Photo A**.

2 Cut a ¾×4×30" blank for the surround tops and bottoms (H) and surround sides (I). Then form beveled strips with one of the methods shown in the sidebar, on *page 87*. With the strips beveled, cut ¼" rabbets ⅛" deep in each one, as shown on **Drawing 2b**. Finish-sand the blanks.

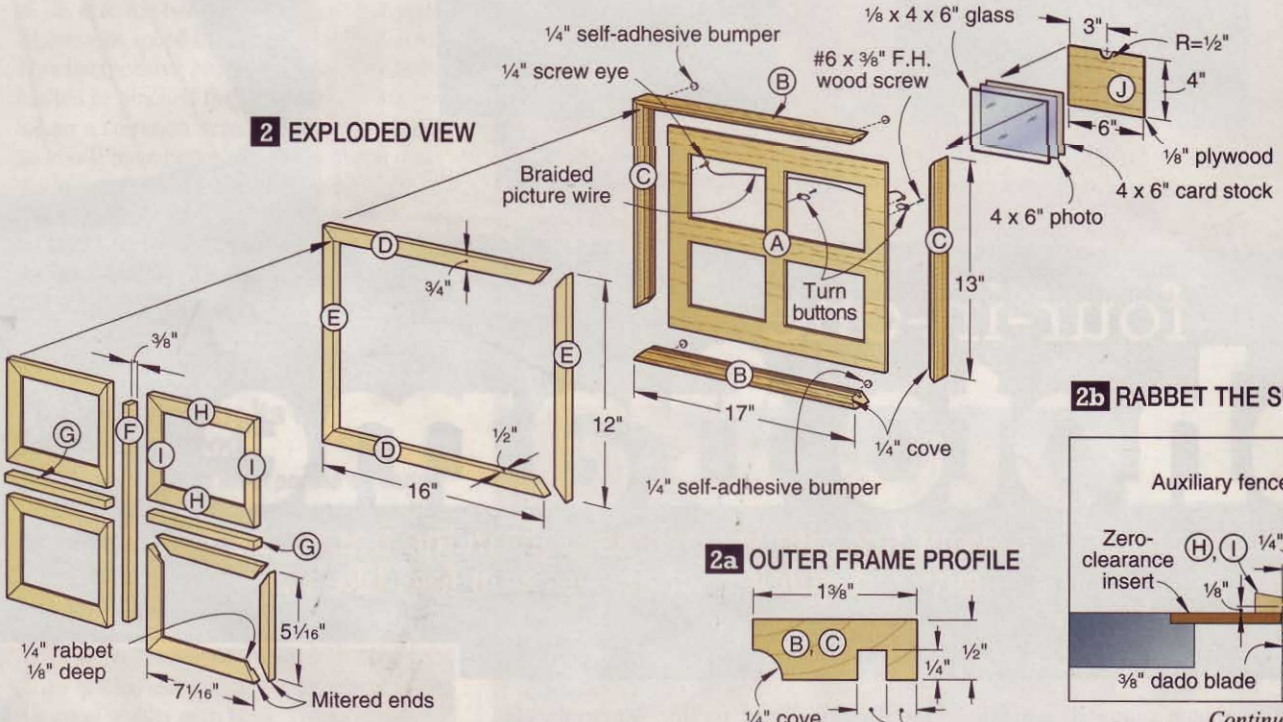
3 From the beveled and rabbeted strips, miter-cut the surrounds (H, I) to length for a snug fit in the four rectangles formed by the dividers (F, G), as shown in **Photo B**. Then glue in the dividers, as shown in **Photo C**.

4 Cut the backers (J) to size. Scrollsaw and sand finger notches in each one, where shown on **Drawing 2**.

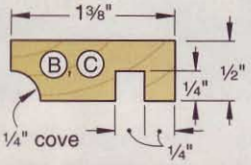
1 BACK
(Viewed from back)



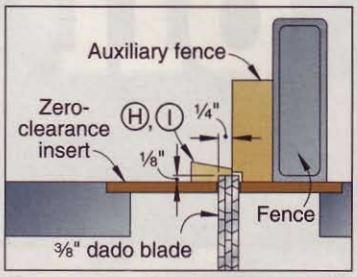
2 EXPLODED VIEW



2a OUTER FRAME PROFILE

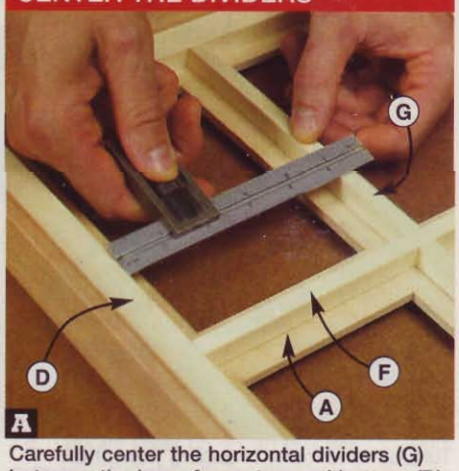


2b RABBET THE SURROUNDS



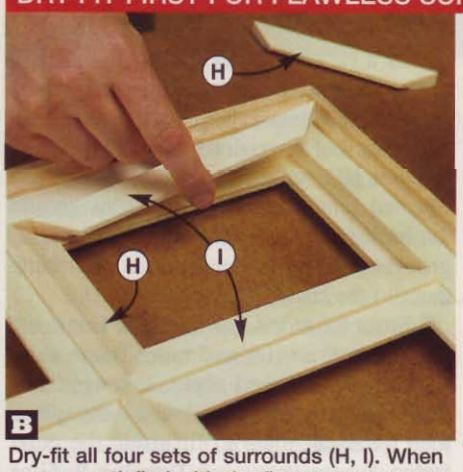
Continued on page 00

CENTER THE DIVIDERS

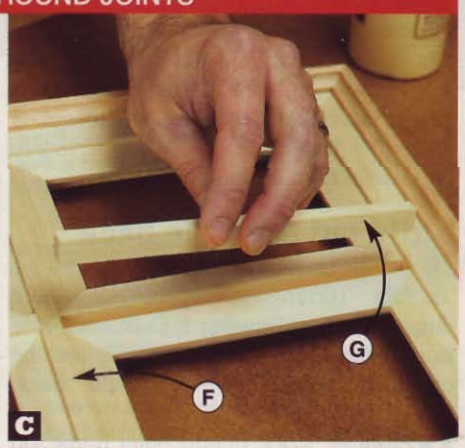


Carefully center the horizontal dividers (G) between the inner frame top and bottom (D). Do not glue the dividers (F, G) in place.

DRY-FIT FIRST FOR FLAWLESS SURROUND JOINTS



Dry-fit all four sets of surrounds (H, I). When you are satisfied with the fit, remove one set at a time, and glue them in place.



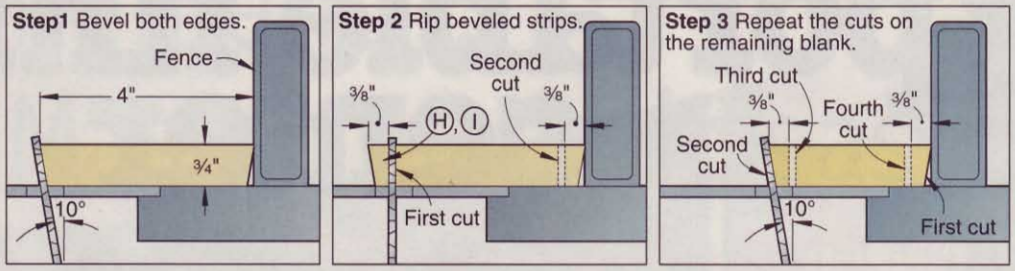
With all the surrounds glued in place, carefully remove the dividers (F, G) one at a time, apply glue to the backs, and reinsert them.

TWO WAYS TO CUT BEVELED WORKPIECES

1 On a tablesaw

The upside: This method does not require a jig. Just follow the three steps shown at *right*.

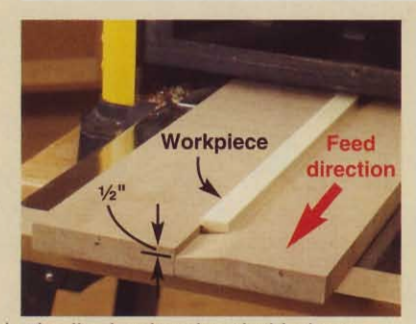
The downside: You'll have to sand saw blade marks from the bevels.



2 With a planer

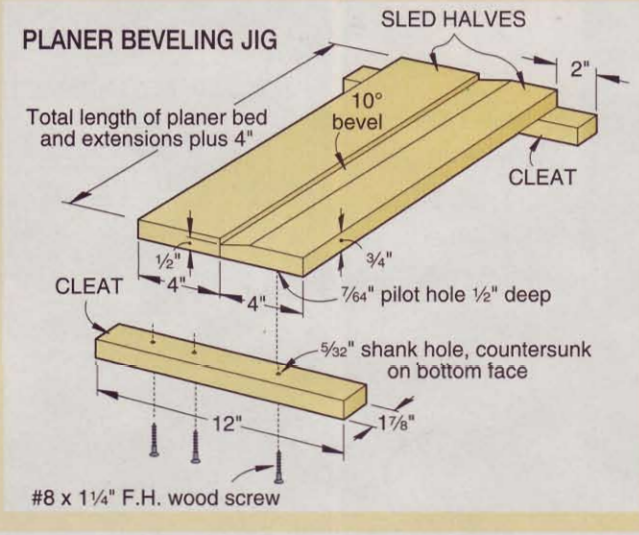
The upside: You'll get clean, smooth bevels that require only finish-sanding.

The downside: You need to build this jig. Here's how.



From ¾" plywood, particleboard, or medium-density fiberboard, cut the cleats and sled halves to the sizes shown on the drawing at *right*. Bevel-rip one of the sled halves where shown, then assemble the jig, butting the sled halves together to form a beveled groove. Place the jig across the bed and extensions of your planer with the cleat on the infeed end against the edge of the extension.

Rip four ⅜"-wide strips from your ¾×4×30" blank. Placing the strips in the jig groove, plane bevels on the blanks in several shallow passes, as shown in the photo *above*.



Now finish and assemble

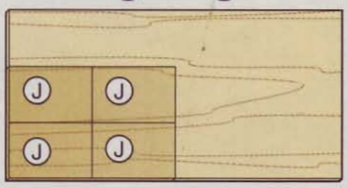
1 Inspect the parts, and resand any areas that need it. Apply a clear finish. (We sprayed on three coats of semigloss lacquer from an aerosol can, sanding with 220-grit sandpaper between coats.)

2 When the finish dries, drill pilot holes where shown on **Drawing 1**, and install turn buttons and screw eyes. Attach braided picture wire to the screw eyes, adjusting its length so the wall hanger will fall within the recess at the back of the frame. Adhere self-adhesive bumpers to the rear edges of the outer frame at the corners.

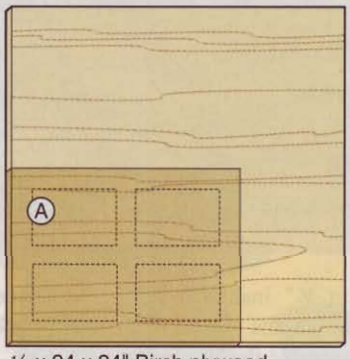
3 Have four 4×6" pieces of single-strength glass cut, and place them in the openings followed by the photos you wish to display. Then, leaving ⅛" for the backer (J), fill the remaining space with 4×6" pieces of cardboard or store about a dozen photos behind each one on display. Place the backers in the openings, and secure them with the turn buttons.

Written by **Jan Svec** with **Kevin Boyle**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**

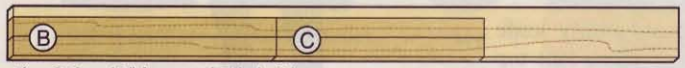
Cutting Diagram



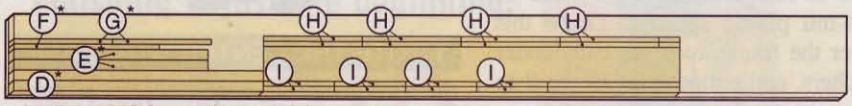
⅛ x 12 x 24" Birch plywood



¼ x 24 x 24" Birch plywood



½ x 3½ x 48" Lauan (.7 bd. ft.)



¾ x 5½ x 60" Aspen (1.5 bd. ft.) *Plane or resaw to the thickness listed in the Materials List.

Materials List

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A back	¼"	12½"	16½"	BP	1
B* outer frame top and bottom	½"	1⅜"	17"	L	2
C* outer frame sides	½"	1⅜"	13"	L	2
D* inner frame top and bottom	½"	¾"	16"	A	2
E* inner frame sides	½"	¾"	12"	A	2
F vertical divider	½"	⅜"	10½"	A	1
G horizontal dividers	½"	⅜"	7 1/16"	A	2
H* surround tops and bottoms	⅜"	¾"	7 1/16"	A	8
I* surround sides	⅜"	¾"	5 1/16"	A	8
J backers	⅛"	4"	6"	BP	4

*Parts initially cut oversize. See the instructions.

Materials key: BP–birch plywood, L–lauan, A–aspen.

Supplies: #6×⅜" flathead wood screws (8), turn buttons (8), ¼" screw eyes (2), #12 braided picture wire, ¼" self-adhesive bumpers (4), single-strength glass.

Blade and bit: Stack dado set, ¼" cove router bit.

Source

Wood and supplies kit. ¼" and ⅛" birch plywood, lauan, and aspen planed to the finished thicknesses for the parts listed *above*, #6×⅜" flathead wood screws, turn buttons, ¼" screw eyes, #12 braided picture wire, ¼" self-adhesive bumpers. Order kit no. W-160 and indicate one of the following quantities: one frame, $19.95 ppd., two frames, $35.95 ppd., five frames, $89.95 ppd. Heritage Building Specialties. Call 800/524-4184, or go to heritagewood.com.

portable finishing center

Apply finishes in a dust-free enclosure that sets up or tears down in just 5 minutes.

Deploy this handy tent any time you want to wipe or brush on a finish without having to shut down work in the rest of your shop. The plastic covering lets in plenty of light and zips shut over a simple frame made of polyvinyl-chloride (PVC) pipe and fittings to protect your project as the finish dries. Best of all, you can build one in an afternoon with about $80 worth of materials available from a home center. Here's how:

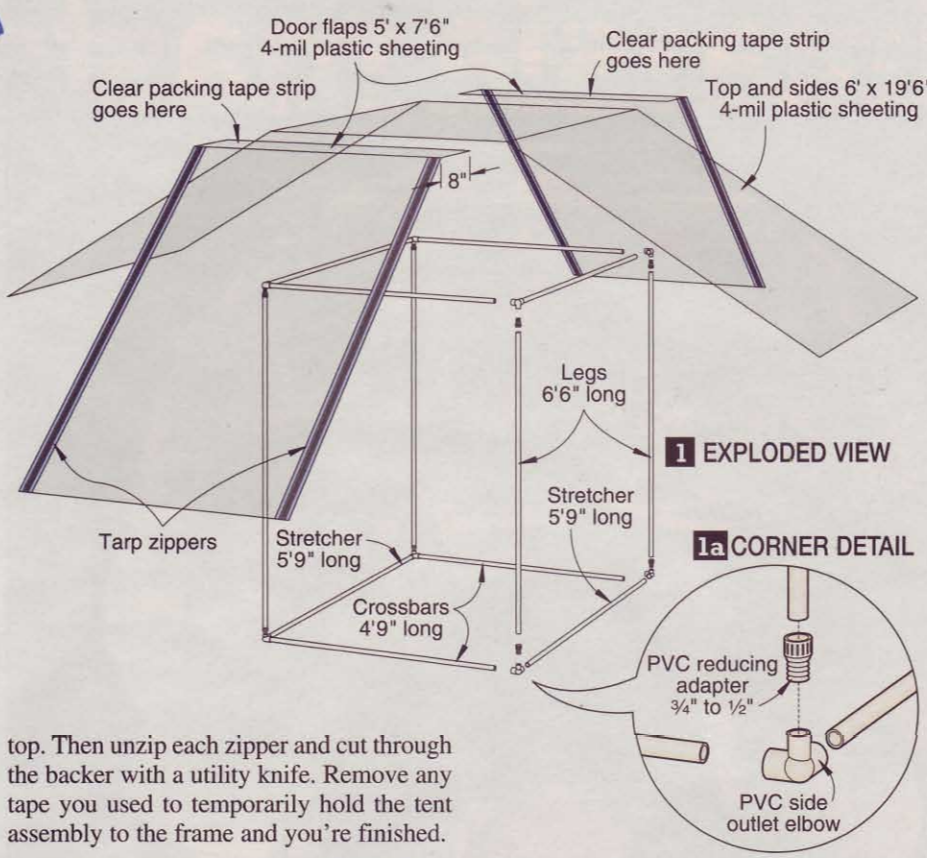
1 Cut ¾" inside-diameter PVC pipe to the lengths shown in **Drawing 1**. Next, dry-assemble the frame using the PVC and fittings as in **Drawing 1a**.

2 Using a straightedge and utility knife or scissors, cut the one-piece tent top and sides to size from a single piece of 10×25' 4-mil plastic sheeting. Drape this piece over the frame, tuck the ends under the stretchers, and temporarily secure it to the frame with masking tape.

1 TOTE THE CENTER WITH EASE

Store the center on your lumber rack or stand it in a corner, then carry it to your location.

Zippers come stitched to a one-piece backer with adhesive applied. Just stick the zipper in place, open it, and cut through the backer.


Door flaps 5' x 7'6" 4-mil plastic sheeting
Clear packing tape strip goes here
Clear packing tape strip goes here
Top and sides 6' x 19'6" 4-mil plastic sheeting
8"
Legs 6'6" long
Stretcher 5'9" long
Tarp zippers
Stretcher 5'9" long
Crossbars 4'9" long

1 EXPLODED VIEW

1a CORNER DETAIL

3 From a second sheet of 4-mil plastic sheeting, cut the two door flaps to size.

4 Mount a pair of self-adhesive tarp zippers to each door. To do this, lay each door on a flat surface. Peel one side of the protective paper off the zipper, as shown in the photo *above*. Position the zipper so the open end is flush with one end of the door and the zipper aligns with the edge of the door. Rub the backing to ensure that the adhesive makes full contact with the door. Note that the zippers are shorter than the doors, which leaves a flap about 8" long at the top of each door.

5 Once you have all four zippers adhered to the doors, position them on the PVC frame. Align the lower edge of each door with the lower crossbar and tuck the flap over the upper crossbar. Now adhere each zipper to the tent sides.

6 Using clear packing tape, secure the flap at the top of each door to the tent top. Then unzip each zipper and cut through the backer with a utility knife. Remove any tape you used to temporarily hold the tent assembly to the frame and you're finished.

Note: *This finishing center is <u>not</u> designed for use as a spray booth. Use it only when applying brush-on or wipe-on finishes, and always keep one door open when working inside. Zip the doors shut to keep dust out as the finish dries.*

Supplies: ¾" inside-diameter PVC pipe, 10-feet long (10); ¾" PVC side-outlet elbows (8); ¾" to ½" PVC adapters (8); 10×25' 4-mil plastic sheeting (1); 10×12' 4-mil plastic sheeting (1); tarp zippers (4). (We found the tarp zippers at The Home Depot. If you don't find them locally, contact the manufacturer at 800/399-4665 or tarpline.com.

Put this center to work anywhere you need to protect a project while the finish dries.

2 ROLL OUT THE PLASTIC TENT

Lay out the tent and remove the frame. The corner fittings stay attached to the stretchers.

3 ERECT THE FRAME IN A FLASH

Assemble the frame by sliding the pipes into the corner assemblies.

4 ZIP IT AND GRAB A BRUSH

Arrange the tent over the frame and zip down the doors to complete the setup.

intarsia masterpeace

With a little scrollsawing, some simple contour sanding, and our easy-to-follow instructions, you can transform a few scraps of wood into this heavenly wall hanging by renowned artist Judy Gale Roberts.

Let's cut out the parts

1 Make seven copies of the full-size intarsia angel pattern from the *WOOD Patterns®* insert. Set aside one copy as a master for reference.

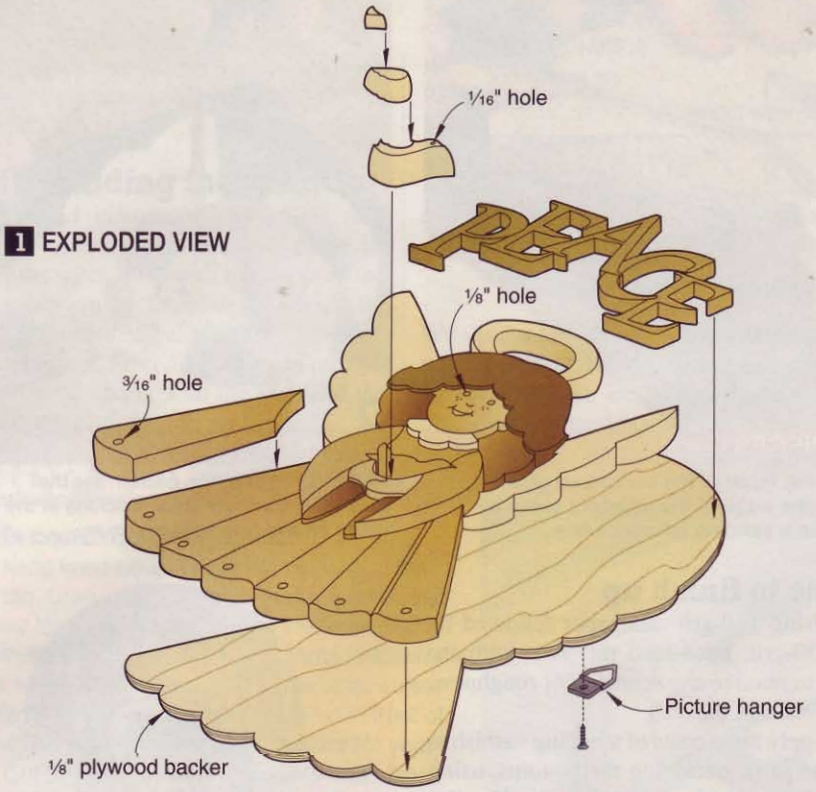
2 From the remaining copies, cut out the pattern pieces. Each piece has a letter on it identifying the wood tone and an arrow showing grain direction. Where adjacent parts have the same color and grain direction, such as those for the gown and "PEACE" lettering, save yourself some work by cutting them out as a group. Cut out two grouped letter patterns with scissors, and set the patterns aside.

3 To make the angel body, round up ¾" scraps having dark, medium, light, and white wood tones. Following Judy's preferences, we used western red cedar for the dark, medium, and light parts, and aspen for the white parts. But you also can use other woods that provide a variety of colors and grain patterns.

4 For each pattern piece, align the arrow on the pattern with the grain on the wood, and move the pattern around until you find the area with the best color and most interesting grain for the piece. Adhere the patterns using a repositionable-type spray adhesive. Then drill holes through the face, gown, and dove, where shown on the patterns and **Drawing 1**, including a blade start hole in the angel's mouth.

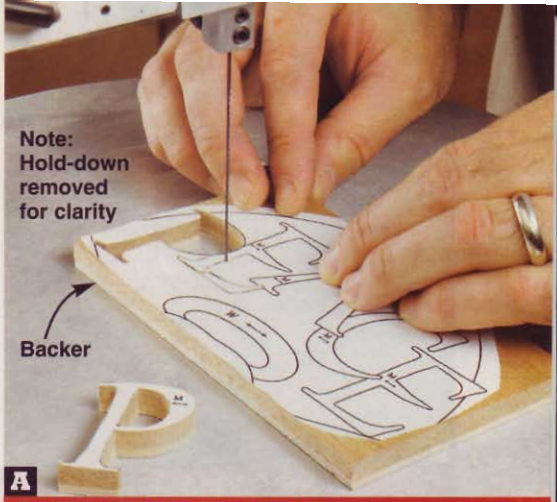
5 Fit your scrollsaw with a no. 2 reverse-tooth blade, and make sure it's square to the saw table. Next, insert the blade through the start hole in the angel's face, and scrollsaw out the mouth. Now cut all of the parts to shape, keeping the blade in the center of the pattern lines. Remove any splinters around the bottom edges of the parts with 120-grit sandpaper.

6 To help visualize the elevation changes and make it easier to contour the parts



later, mark around the edges of the parts the thicknesses shown on the pattern pieces. (We used an adjustable square to do this.) Then, using a disc or belt sander with 120-grit sandpaper, sand the parts to the marked lines, removing the patterns as you sand.

7 To make the "PEACE" letters, prepare a ¼×4×6½" blank from a medium-tone hardwood, such as walnut, cherry, or mahogany (our choice), and a same-size piece of scrap ⅛" or ¼" plywood or hardboard for a backer. (Because the letters are thin, we used a hardwood to prevent splitting.) Adhere the backer to the blank with double-faced tape. Spray-adhere one of the letter patterns to the blank. Now cut out the letters, as shown in **Photo A**. Carefully pry the letters from the backers.



CUT OUT THE LETTERS

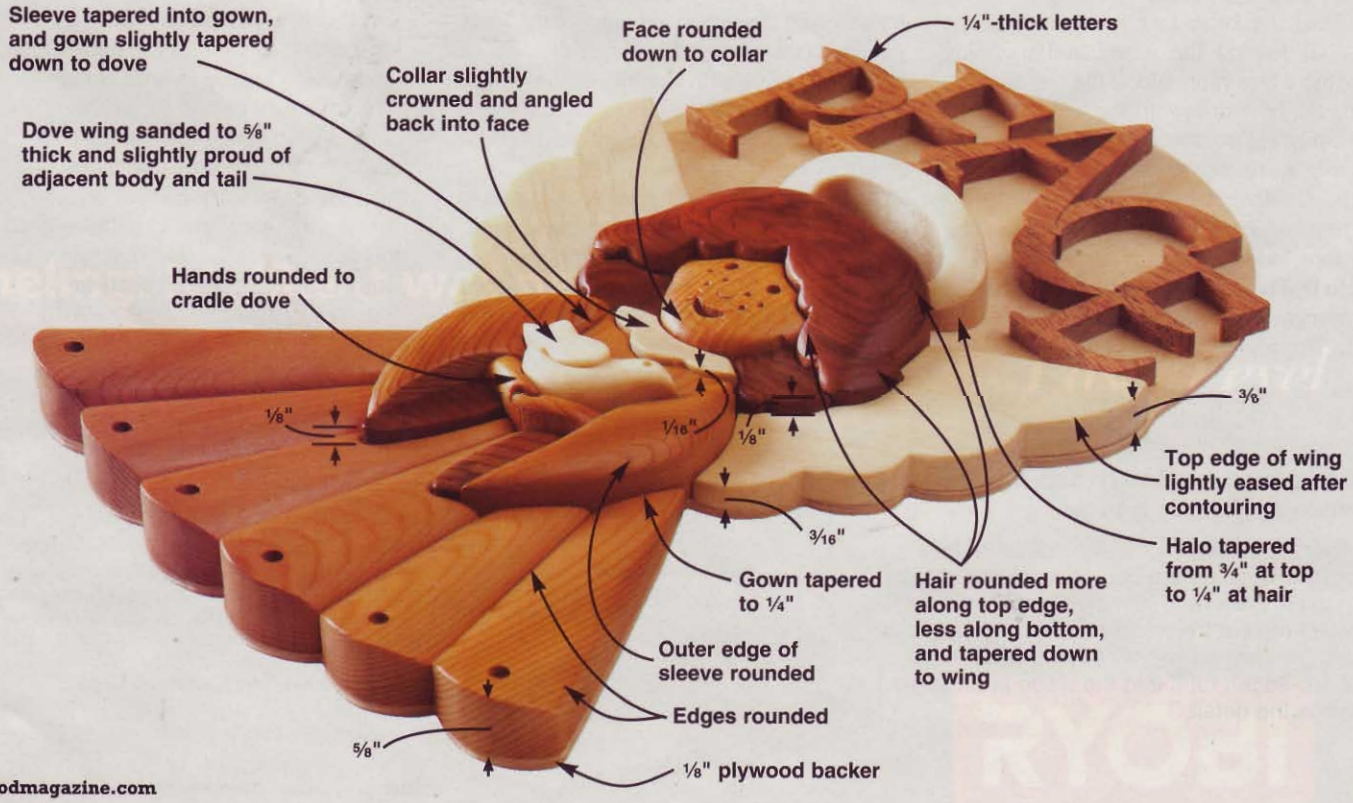
Using a backer to prevent tear-out, scrollsaw out the letters from the blank. For letters "P" and "A", cut out the openings first.

Now contour the pieces

1 To keep the parts in position while marking them for contouring, cut an 8×12" piece of ⅛" or ¼" scrap plywood or hardboard. Apply a light coat of spray adhesive to one face. Then assemble the angel body on it.

2 Starting at the bottom, remove the left gown piece. Then, referring to the **Contouring Guide** *below* and to **Photo B** on *page 92*, sand the part to shape. We used a 3"-diameter pneumatic sanding drum (see **Sources**), inflated to 5 psi, with a 120-grit sanding sleeve, to contour the parts. An oscillating spindle sander, disc sander, or sanding drum also will work.

CONTOURING GUIDE


Sleeve tapered into gown, and gown slightly tapered down to dove
Face rounded down to collar
¼"-thick letters
Collar slightly crowned and angled back into face
Dove wing sanded to 5/8" thick and slightly proud of adjacent body and tail
Hands rounded to cradle dove
1/8"
1/16"
1/8"
3/8"
Top edge of wing lightly eased after contouring
3/16"
Halo tapered from ¾" at top to ¼" at hair
Gown tapered to ¼"
Hair rounded more along top edge, less along bottom, and tapered down to wing
Outer edge of sleeve rounded
Edges rounded
5/8"
⅛" plywood backer

B

C

TWO TRICKS FOR SHAPING THE GOWN PIECES

Sand the top face of the gown piece so it tapers from 5/8" at the bottom end to 1/4" at the top. Then round over the long top edges.

Mark the taper of the contoured gown part along the edge of the adjacent piece to provide a sanding reference line.

D

FRECKLE THE FACE

Referring to the face pattern for the locations, form six small freckles in the face using an awl and light pressure.

Note: Be careful not to sand completely around the edges of parts. Doing so will leave gaps between them.

3 Reposition the contoured gown piece on the plywood or hardboard. Then mark the taper on the adjacent gown part, as shown in **Photo C**, and remove the part. Using the marked reference line as a guide, sand the taper on the part and round over the edges. Refit the part as needed to check your sanding progress and ensure a smooth transition with the first contoured part. Repeat the process to shape the remaining gown pieces.

4 Remove the wings, and sand them so they taper from 3/8" along the outside edges to 3/16" along the inside edges adjacent to the body. Then lightly ease the top outside edges of the wings, where shown on the **Contouring Guide**.

5 Sand the large hair part, tapering the ends toward the wings and rounding over the edges more along the top and less along the bottom toward the face.

6 Using the contoured gown, wings, and hair as reference points, and referring to the **Contouring Guide**, mark and sand the remaining parts to shape. After sanding the face, add freckles to it, as shown in **Photo D**. Then form the nose and dimples at the corners of the mouth, as explained in the **Shop Tip**, *below*.

Time to finish up

1 Using 180-grit sandpaper followed by 220-grit, hand-sand the parts with the grain to remove any scratches or roughness. Then remove the dust.

2 Apply three coats of a wiping varnish to the parts, excluding the bottoms, using a 1" foam brush. (We used Bartley Gel Varnish, Clear Satin.) Wipe off the excess and buff the parts with soft paper towels or clean rags until they're nearly dry to the touch. Let each coat dry for 6 hours.

3 To make an exact-size plywood backer for the angel, apply a light coat of spray adhesive to an 8½×11" piece of paper. Assemble the angel body on the paper, and trace around the angel up to the wing tips. Remove the parts, and cut out the pattern.

Spray-adhere the pattern to an 8×12" piece of 1/8" birch plywood. Complete the pattern by adhering the remaining copy of the letter pattern to the plywood, aligning the ends of the outer radius with the tips of the wings. Scrollsaw the backer to shape. Remove the pattern using lacquer or paint thinner. Then sand the backer smooth.

4 Finally, glue each part to the backer using a couple drops of yellow woodworking glue. Attach a picture hanger to the backer. Now place the angel in a special place where you can admire her tranquil beauty and your handiwork.

Interested in other angels?

If you enjoyed making the "Peace" angel and would like to create a host of them, Judy Gale has designed four companion angels, including the "Hope" angel *above*. (The other angels have the words "Love," "Joy," and "Faith.") To purchase these patterns or to receive a free catalog filled with other intarsia patterns and book, video, and class offerings, visit Judy Gale Roberts' Web site at intarsia.com, or call 800/316-9010 (865/428-8875 if outside the U.S.).

SHOP TIP

In a pinch, a glue brush handle makes a handy gouge

Here's a simple way to form small details in a project, such as the curved nose and dimples in the angel's face. Simply squeeze the hollow metal tube at the handle end of a glue brush into the desired shape. Then press the sharp-edged tube into the wood at an angle to incise the detail.

Supplies: Repositionable-type spray adhesive, double-faced tape, hollow metal glue brush, picture hanger.

Blade: #2 reverse-tooth scrollsaw blade.

Sources

Pneumatic sanding drum and adapter. 3×9" pneumatic drum no. DT31265, $45.95; drill-press drum adapter no. FF43081, $14.95; 120-grit 3×9" sanding sleeve no. PU00746, $2.10. Call Klingspor's, 800/228-0000; woodworkingshop.com.

Written by **Owen Duvall** with **Kevin Boyle**
Project design: **Judy Gale Roberts**
Illustrations: **Roxanne LeMoine**

shop-proven products

These woodworking wares passed our shop trials

Craftsman elevates hybrid tablesaws

A growing trend in stationary tools is the "hybrid" tablesaw, which combines elements of both contractor- and cabinet-style tablesaws. For about $900, a hybrid gives you beefier components, such as cast-iron extension wings and an upgraded fence. However, its mid-range power and construction—with small trunnions that hang the blade drivetrain from the bottom of the table—make it more like a contractor-style saw than a cabinet saw.

Now, Craftsman blows that definition out of the water with its model 22114, a left-tilting hybrid saw with large trunnions that mount to the cabinet, like a true cabinet saw. The result is a $650 tablesaw that holds its settings well and adjusts easily if it ever goes out of alignment.

At 385 lbs, the 22114 is 50–100 lbs heavier than a contractor-style saw, and the added weight dampens vibration nicely: This is one smooth-running saw. Its 1½-hp motor had no trouble ripping 2"-thick red oak. The chute inside the cabinet directs dust to a 4" port.

One feature of the 22114 that I wish was on every tablesaw is the easy-on/easy-off splitter/blade guard. With a twist of one knob, I could remove the guard for dado cuts, and just as easily reinstall it. I also like the stout miter gauge with its tall fence and stock clamp.

The 22114's front-locking fence has a sliding face, which is handy for indexing crosscuts without trapping the workpiece between the blade and fence. Also you can opt to lock the fence to the rear rail to keep it from lifting when used with feather boards. The fence rail centers on the blade, so it provides 24" of rip capacity on the left and 25" on the right. I rarely cut on the left side of the blade, though, and would rather see that capacity put to use on the right of the blade. The fence deflected an acceptable .010" while ripping sheet goods.

The step-up version of this saw (#22124, $950) comes instead with a 30" Biesemeyer Commercial fence (18" left-rip capacity) as well as a knockdown outfeed table, 1¾-hp motor, and upgraded blade. Sears also sells a lower cost version of the saw I tested, the 22104 ($530). It lacks the 22114's sliding fence face, miter gauge, and dust port, and has stamped-steel extension tables and only 14" of left-rip capacity.

—Tested by Pat Lowry

Craftsman 22114 hybrid tablesaw

Performance	★★★★☆
Price	$650

Available at Sears or at craftsman.com.

Finally, a machine lube that doesn't collect dust

It's ironic that the lubricants we use to make the elevation and bevel gears of our tablesaws operate smoothly attract dust like a magnet, gumming up the very mechanisms we seek to free up. I don't relish reaching inside my cabinet saw to brush away that pasty gunk, and since I started using PG2000 Penetrating Lubricant, I no longer have to.

Designed originally for bicycle chains (another mechanism that gets gritty in use), this waterlike aerosol spray creates a molecular-level barrier between metals to reduce friction. After wiping away most of the greasy sawdust around the gears inside my tablesaw, I sprayed PG2000 on them, then worked it in by moving, sliding, and cranking the parts that make contact with each other. Although the mechanisms operated smoothly for a few days, they seemed to stiffen again, so I applied more and called the folks at ProGold. They told me that it's normal to apply it frequently at first. Sure enough, after a few applications, it seemed to last much longer before needing reapplication.

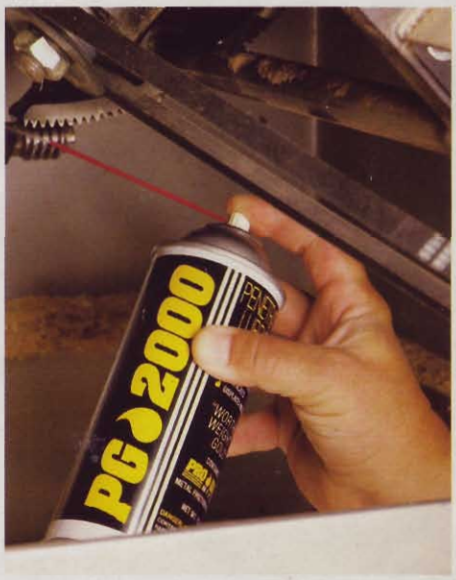
I now use PG2000 under my tablesaw about once a month as a matter of maintenance (you may go much longer, depending on how often you use your saw), and it takes just seconds to apply. I've also used it successfully on my drill press, jointer, and portable planer.

—Tested by Chuck Hedlund

PG2000 Penetrating Lubricant

Performance	★★★★☆
Price	$8 for 12 oz.

ProGold Lubricants
800/421-5823; progoldmfr.com



Continued on page 96

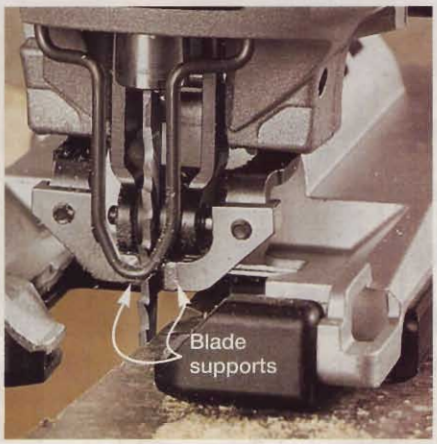
The accuracy of a bandsaw in the palm of your hand

Some woodworkers shun jigsaws for making curved cuts because the largely unsupported blade can deflect, leaving them with a ragged edge that's not square to the face of the workpiece. Bosch's 1590EVSK top-handle jigsaw sports blade supports just above the shoe (base) to prevent that deflection, similar to guide blocks on a bandsaw. I cut circles in 2×6 Douglas fir and if the blade strayed from perfectly vertical, I couldn't measure it.

That might be reason enough to want this jigsaw, but Bosch engineers added some other neat features as well, such as a one-touch blade-changing system that pops out a spent blade by merely flicking a lever on the front of the saw. I also like the shoe, which can be locked and unlocked without the use of tools. I found the shoe's bevel scale easy to read and the 45° stops dead-on accurate.

The 1590EVSK backs up the bells and whistles with a 6.4-amp variable-speed motor (the most robust I've seen on a jigsaw) with electronic speed control that pours on more power when the going gets tough. Despite the power, the jigsaw has good balance and feel, especially for a top-handle saw. (If you prefer a barrel grip, model 1591EVSK has the same features, power, and price.)

—Tested by Larry Arnold



Bosch 1590EVSK
top-handle jigsaw

Performance	★★★★★
Price	$170

Bosch
877/267-2499; boschtools.com

About our product tests

We test hundreds of tools and accessories, but only those that earn at least three stars for performance make the final cut and appear in this section. Our testers this issue include **Larry Arnold**, **Pat Lowry**, and *WOOD*® magazine Master Craftsman **Chuck Hedlund**, who have more than 100 years woodworking experience between them.

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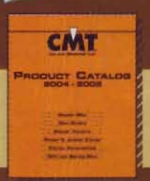

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all-aboard animal train

Put young kids on the fast track to fun with this colorful, quick-to-build project.

1 Gather scraps of ¾"-thick stock to create the train. The wood species needn't be the same for each piece if you paint the train, as we did. The locomotive and animals are all less than 4"-long, but we suggest you start with slightly longer pieces to ensure safe machining.

2 Set your tablesaw blade and fence to cut a groove along one edge of each workpiece, where shown in the drawing. These grooves will receive a length of ⅛" nylon cord that connects the animals together.

3 Make a copy of the animal patterns from the *WOOD Patterns*® insert. Then adhere the patterns to the workpieces, aligning the base of each pattern with the grooved edge of each workpiece.

4 Drill the appropriate holes in each workpiece, where shown on the patterns.

5 Install a #12 blade in your scrollsaw and cut the animals to shape. You'll have to thread the blade through the 3/32" blade-start holes in the elephant trunk and tail. Also cut the kerfs, where indicated, for the elephant and gorilla legs.

6 Sand the animals through 220 grit, and then paint them to your liking. We sprayed on primer plus three color coats. See **Sources** for the colors we used.

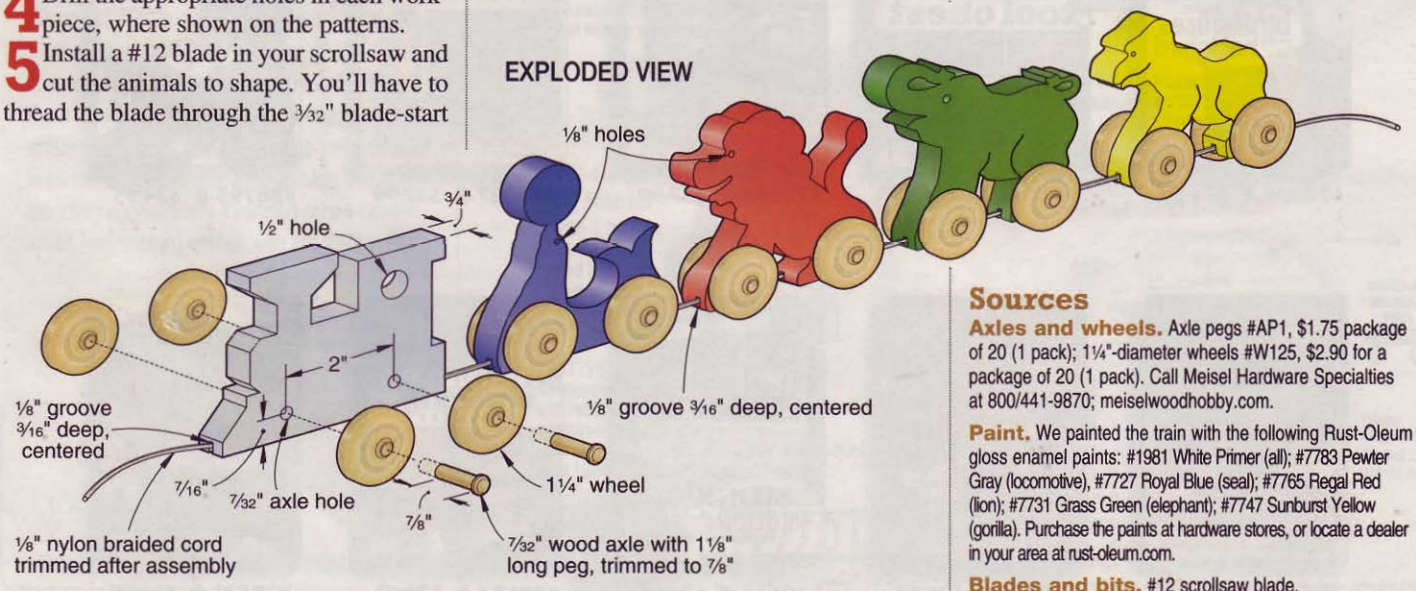
7 After the paint dries, spread 5-minute epoxy in the groove in each train piece. Insert a length of ⅛" nylon cord, leaving about 1" between animals. Cut the excess from the front of the locomotive and back of the gorilla after the epoxy cures.

8 Trim the shaft portions of the axle pegs to ⅞" long. You can do this by eye at the scrollsaw, or make a simple guide by drilling a 7/32" hole through a scrap cut to ⅞" wide. Just insert each axle into this hole and cut off the portion that protrudes.

9 Coat the wheels and the ends of the axle pegs with clear polyurethane finish.

10 When the finish dries, slip a wheel onto each axle peg. Place a drop of glue on the inboard end of an axle, then push it into an axle hole. Do the same with the mating axle, and then press the ends of the axles together. Before the glue sets, slide the pair of axles back and forth until they protrude evenly from each side and neither wheel binds. Repeat this procedure to install the remaining wheels.

Project Design: **Mike Mittermeier**



Sources

Axles and wheels. Axle pegs #AP1, $1.75 package of 20 (1 pack); 1¼"-diameter wheels #W125, $2.90 for a package of 20 (1 pack). Call Meisel Hardware Specialties at 800/441-9870; meiselwoodhobby.com.

Paint. We painted the train with the following Rust-Oleum gloss enamel paints: #1981 White Primer (all); #7783 Pewter Gray (locomotive), #7727 Royal Blue (seal); #7765 Regal Red (lion); #7731 Grass Green (elephant); #7747 Sunburst Yellow (gorilla). Purchase the paints at hardware stores, or locate a dealer in your area at rust-oleum.com.

Blades and bits. #12 scrollsaw blade.

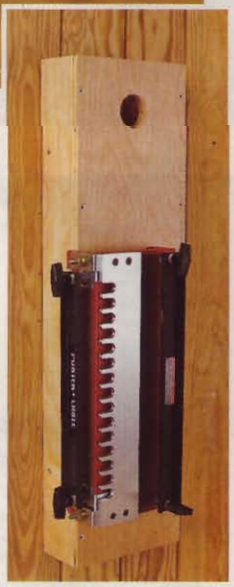
dovetail jig station

Maximize stability and convenience when cutting dovetails with this fold-up benchtop project.

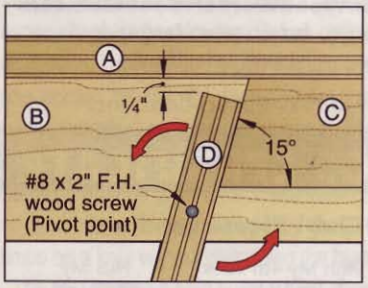
Built from ¾" plywood, this sturdy support holds your favorite dovetail jig at a comfortable working height. Simply unfold the legs, clamp them to your workbench, and you're ready for fine joinery. Use the 2" bit hole so you can rest your router upright. (Wait until the bit stops spining before positioning it into the hole.)

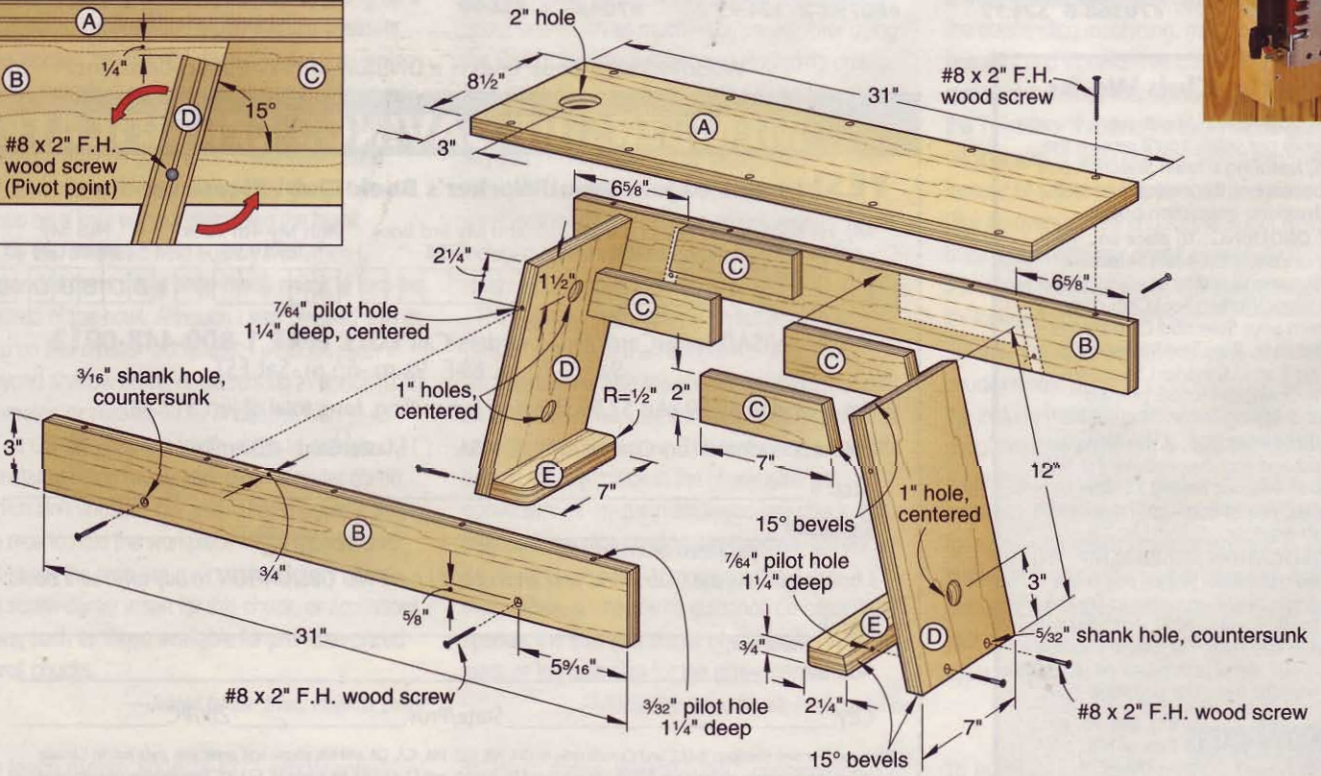
Use the drawing *below* to build the support. As illustrated in the Pivot Point Section View, the support's two legs (D) swivel on the 2" screws mounted into the side rails (B), allowing you to fold up the legs for space-saving storage. With the legs folded down, parts C act as stops, positioning the legs. Use the bottom 1" finger holes in the legs for ease when unfolding the legs, and the top 1" hole in the left-hand leg for hanging the support—dovetail jig attached—when the routing is completed.

Project design: **Jeff Mertz**



PIVOT POINT SECTION VIEW





shop tips

Helping you work faster, smarter, and safer

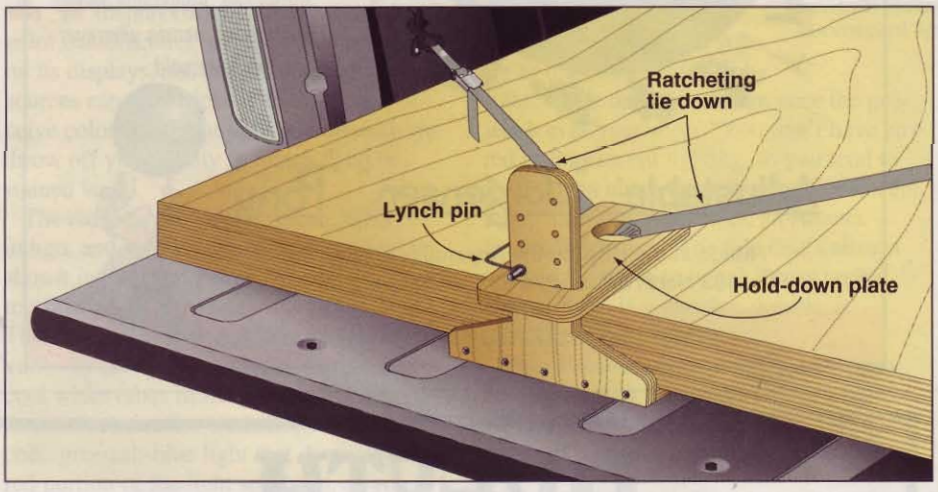
Making short beds work for long sheet goods

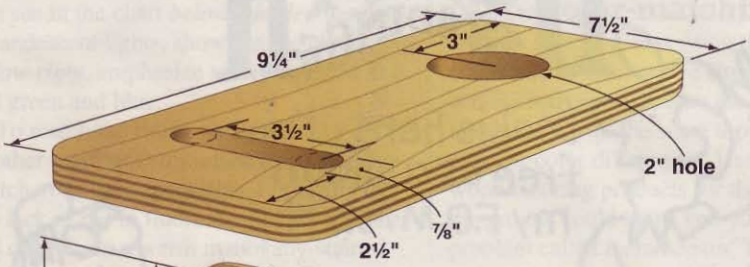
Standard sheet goods fit in a short-bed pickup truck if you lower the tailgate. This method works fine until you encounter an incline. Then the sheets tend to unload themselves, leaving you with damaged goods, not to mention a red face.

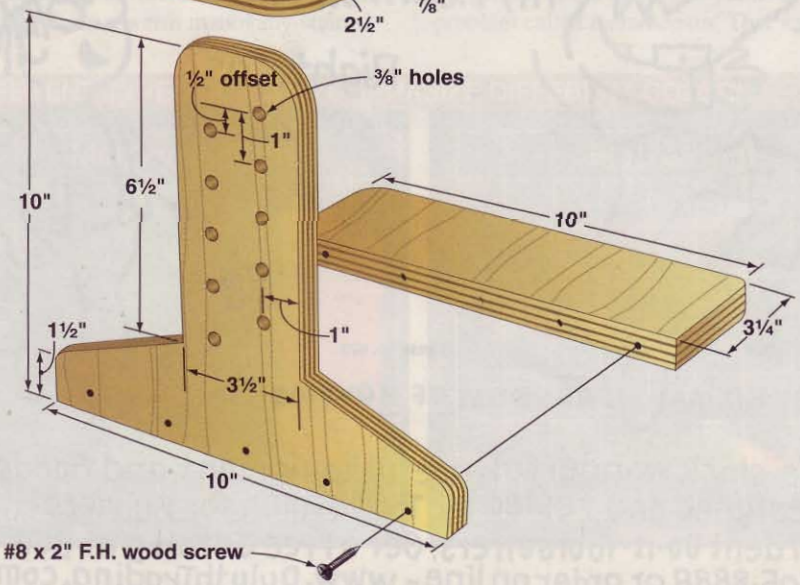
To secure the sheets and prevent spillage, make this adjustable hold-down and backstop out of scrap plywood. The L-shape backstop rests under the sheet goods and has holes in the vertical support to accept a lynch pin for lock-in-place adjustability. The circular hole in the hold-down plate accepts a tie-down strap secured to the truck's bed.

—Joe Spurlock, North Vernon, Ind.

top shop tip







Our Winner

Richard Young Photography

Joe Spurlock's life seems to have come full circle. His first job out of high school was at Vernon Swing Factory, cutting out parts for white oak porch swings. Recently, after retiring from his career at Cummins Diesel at the ripe age of 48, our Top Shop Tip winner rekindled his love of woodworking and set up shop. One of Joe's favorite projects is the porch swing he's relaxing in, *above*.

We're rewarding Joe Spurlock with a Grizzly G0444 tablesaw for sending in this issue's Top Shop Tip. Way to go, Joe!

Top tips win tools!

Describe how you've solved a workshop dilemma, and you'll earn $75 if it appears here. If your tip garners Top Shop Tip honors, you'll also win a tool prize worth at least $250.

Send your best tips, along with photos or illustrations and your daytime phone number, to: **Shop Tips, *WOOD* Magazine, 1716 Locust St., GA-310, Des Moines, IA 50309-3023**. Or e-mail tips to: **shoptips@woodmagazine.com**. Remember to include your contact info in the e-mail as well.

Because we try not to publish tips seen elsewhere, please send your tips only to *WOOD* magazine. Sorry, submitted materials can't be returned.

Babying polyurethane pays off in performance

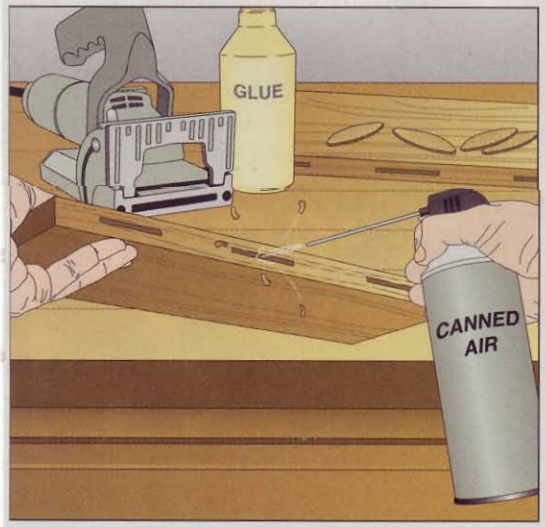
Anything that gets cold tends to move slower. This can be aggravating when you're trying to coax cold glue, especially polyurethane, from a bottle. To keep my glue flowing freely, I purchased a baby-bottle warmer with adjustable heat settings. I set the warmer on a low setting, add water to the warmer, and insert the glue bottle for 4–6 minutes. This trick works for both water-based wood glues and polyurethane glue.

—Ray Bruntmyer, Arlington, Texas

Tight area dust buster

I keep a can of compressed air in my shop. (It's the same stuff computer technicians use, and you can find it at electronics and office supply stores.) The small blast of air works great to clean out countersunk nail holes, biscuit slots, and other places you don't want to drag the air hose when you just need a few strong puffs of pressurized air.

—Dave Nelson, Houston



Continued on page 104

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1 Plunging Roundover
1 Stepped Cove
2 Edge Beading Bits
1 Multibeading Bit
1 Bowl & Tray Bit
1 Key Hole Bit
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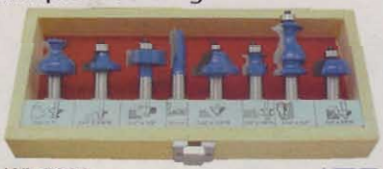

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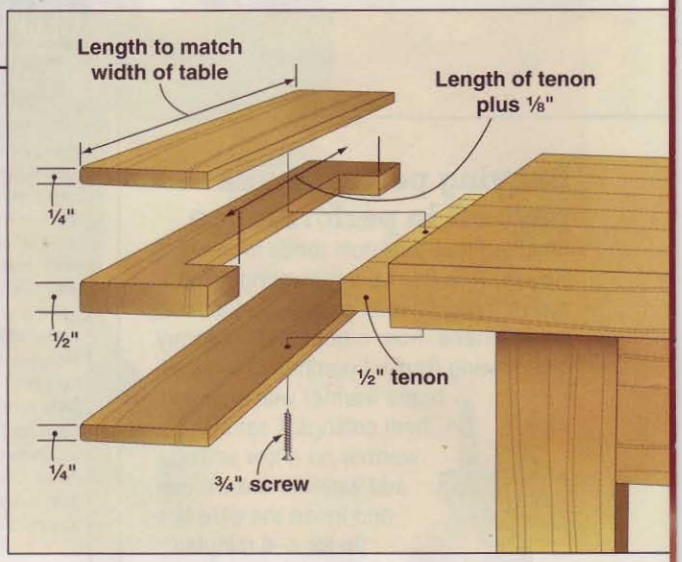
Circle No. 310

Serve up a breadboard end without tricky mortises

Recently, I built an oak dining room table and wanted to use breadboard ends to conceal the tabletop's end grain. However, lacking a mortising jig, I needed a simpler way to create a mortise to accept the tabletop's tenon. The solution I created is a three-layer breadboard end with the sum of the three layers equaling the tabletop's thickness.

To ensure consistency of color and grain, I resawed the three layers from a single thick board and planed them to the thicknesses shown. (For a 1"-thick tabletop, for example, plane the top and bottom thicknesses to ¼" and the center board to ½".) The notched center layer fits around the tabletop tenon with 1/16" clearance on both ends to allow for grain expansion across the width. I laminated the layers together, slid the breadboard end over the tenon, and attached it. A screw or dowel driven from below through the center of the tenon does the trick.

—Alex Nadler, Swansea, Ill.



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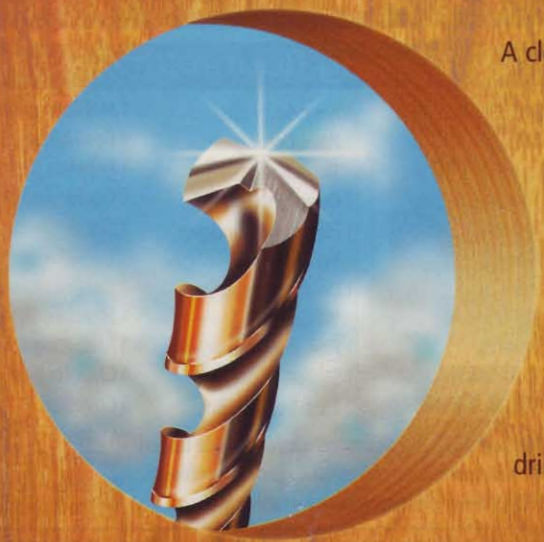

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Circle No. 1511

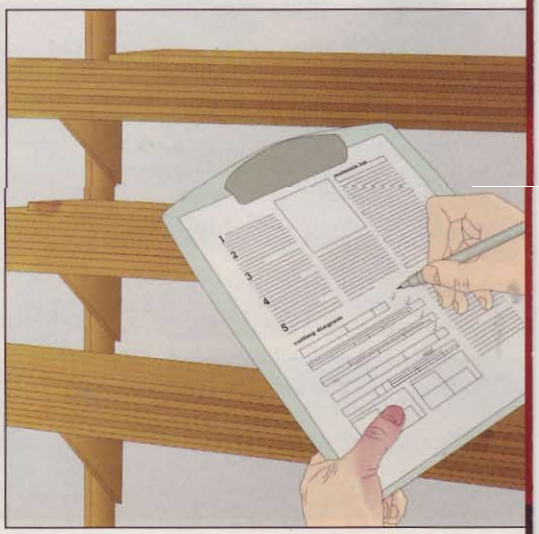
Buy only what you need to save time and money

Like most woodworkers, I'd rather build projects than run after forgotten materials or supplies. So to make the most of both my time and materials, I developed a record-keeping system that gives my memory a rest and lets my hands get to work.

When starting a new project, I make two copies of the materials and supplies list from the project plans, and one copy of the plans themselves. I then slip the latter copy into a vinyl sheet protector and put one copy of the materials list in the back, facing out for quick reference.

The other materials list becomes my working copy that I first take to the shop to cross off the supplies I already have in stock. With the updated list in hand, I make only one supply run.

—Diane Goularte, Fresno, Calif.

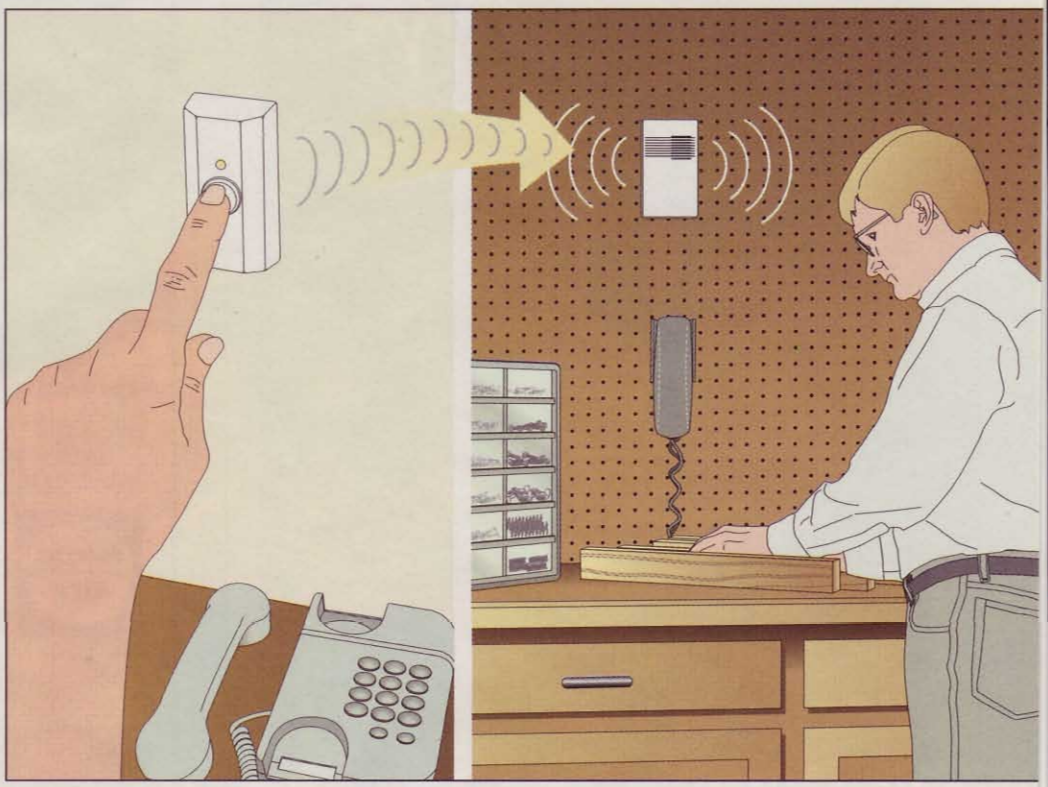


Shop steps saved by the bell

When I added a telephone line to my detached workshop, I thought I had achieved a new level of convenience that would save many steps. The problem was, my wife and I are both frequently home and each of us answers the phone. If she answered and the call was for me, she would have to come trudging out to the shop. If the reverse happened, I would stop what I was doing and go fetch her.

The solution turned out to be an inexpensive wireless doorbell. I mounted the button in the house near the phone my wife uses most often, and I installed the chime in my workshop. Now, my wife always answers and, if it's for me, she "rings my bell." The system is very reliable and the chime loud enough to hear over most of my machinery.

—H.J. Boger, Rockwell, N.C.



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what's ahead

A preview of some of the articles in the February/March issue (on sale January 18)

Projects for your home and shop

FEATURED PROJECT

Ultimate Closet Storage System

No matter the size or shape of your closets, you can get them organized by building and installing these modular components.

Accent Lamp

Add a warm glow to tabletops with this surprisingly easy-to-build piece.

Wavy Rim Bowl

Even beginners will have success making this tricky-looking vessel. That's because it's turned like a simple round bowl, then squared on a bandsaw.

Biscuit Jig

If you're looking for more ease of operation and accuracy from your biscuit joiner, check out this problem-solver.

Mission Blanket Chest

The stunning, sturdy, oak bedroom set continues with this matching piece.

More tips, tools, & techniques for better woodworking

SHOP TESTED

14.4- and 15.6-volt drills

See how 20 cordless drill/drivers fared in head-to-head tests. Hint: Three of them drove more than 500 1⅝" screws on a single charge.

Sanding shortcuts

There's nothing fun about sanding, but how well you do it impacts your project in a big way. Learn quick and effective ways to reach the desired results.

Get more life from rechargeable batteries

New batteries for cordless tools cost big bucks, so follow these tips to make them last longer.

How to imitate high-priced woods

Want to make poplar look like cherry? Lauan like Honduran mahogany or maple like ebony? Here's how.

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